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UME 27 OCTOBER 31, 1938 NO. 22

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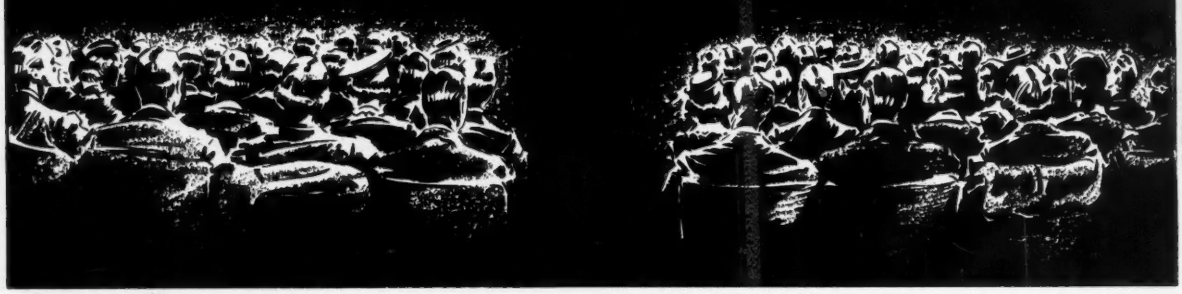

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Official Publication of the American Association of Textile Chemists and Colorists

THE OBJECTS OF THIS ASSOCIATION ARE:

"To promote increase of knowledge of the application of dyes and chemicals in the Textile Industry.

"To encourage in any practicable way research work on chemical processes and materials of importance to the Textile Industry.

"To establish for the members channels by which the interchange of professional knowledge among them may be increased."

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AMERICAN
DYESTUFF REPORTER

VOLUME 27 OCTOBER 31, 1938 NUMBER 22

Permanent Finishes*

R. J. SMITH

The author of this article discusses the various finishes, including the newest types, that are being used in England. The article should prove of interest to finishers in this country.

THE word "permanent" is often used now-a-days with a meaning not sanctioned by any dictionary. Although the word is defined as "lasting" or "enduring indefinitely," it is used loosely in such associations as "permanent waving" and "permanent finishes." Such use, however, cannot be justified in either case and the present author considers that the term "durable" is much to be preferred. Only a finishing process that confers, upon a fabric or yarn, properties which remain unaffected under all conditions of wear or treatment to which the goods are normally subjected, should be termed "permanent." On the other hand, if, in spite of wear and tear, a considerable portion of the finish or its effect is still in evidence when the goods become unserviceable, a satisfactory description is "durable finish."

The word "permanent" is becoming almost as ill-used and ill-applied as the words "fast" and "fadeless" in connection with colored textiles. Before it is too late, it might be advisable to consider the use of a description, e.g. "durable finishes," as less liable to give rise to claims difficult to support.

The finishing processes used in the textile industries give finishes which are either—(1) Temporary or impermanent, or (2) durable or lasting; the latter are commonly called "permanent" finishes.

The following well-known finishes are found in the first group—(*a*) Mechanically produced finishes, e.g. beetled, schreinered and calendered styles, and such effects as embossed velvets and taffetas, and glazed chintz finishes. All these are produced by mechanical action alone and all lack resistance to wet processes; and (*b*) filled effects produced by the use of starches, gums, Epsom salt, and china clay or other mineral fillers; also softened styles obtained by the use of oleine, palm and other oils, waxes and fats, and finishes resulting from the use of deliquescent substances, e.g. magnesium chloride, glucose, glycerol, etc. Delustered finishes on rayon, and showerproof finishes resulting from the use of wax emulsions and aluminium salts, are also included in this sub-group, the production of which involves the deposition on or within the fabric of substances which, in all cases, are removable by subsequent washing or dry cleaning. Consequently, their finishing effect is temporary or impermanent.

The second group, i.e. the durable finishes, include a most extensive series of finishes of several types, which may be divided into three classes, viz.—(1) Those produced by mechanical means alone; (2) those dependent upon deposition of substances within or upon the material; and (3) those resulting from chemical modification of the fibers forming the fabric.

Following this classification and considering first those produced by mechanical means alone, the most commonly used finish in this group as far as the wool trade is concerned is, of course, milling. This is a truly durable finish since no commercial method exists for restoring a milled fabric to its original state. There is also good reason for placing this finish first in the list of durable finishes considered here, since in the time of Usertesen II (B.C. 1800), fulling mills existed. The fully shrunk finishes produced by the Rigmel and Sanforizing processes are of importance in the cotton industry. Although they differ in method of operation, both of them yield a durable finish produced by mechanical means alone.

A much wider range of finishes is found in the second class of durable finishes, i.e. those depending upon deposition of the finishing agents employed within or upon the fabric. This class includes cellulose ether finishes, synthetic resin finishes in printed, embossed and crease-resistant styles, rubber latex finishes on wool and fixed starch finishes on cotton. In addition, although not strictly a finisher's effect, Trubenized or bonded fabrics might be included.

The third and last class is one in which a great amount of activity is being shown at the present time, although the earliest member of this group is probably represented by mercerized finishes. Other finishes falling within this group are the unshrinkable finish produced by the chlorination of wool, the process for imparting to cotton resistance against direct cotton dyes, and the Heberlein processes for the production of organdie finishes. The introduction of ethylene oxide finishes on cotton, the sulfuryl chloride

* Presented before West Riding Section, Society of Dyers and Colourists, February 10, 1938. Abstracted from journal of the Society of Dyers and Colourists.

method of rendering wool unshrinkable, and the durable water-repellent and softened finishes on all classes of fiber given by special finishes, are examples of recent developments in durable finishing processes. Some examples from each of the last two groups of durable finishes are of interest.

In the second group, synthetic resins offer a wide range of possibilities, both for immediate application and for future development. They are best known in connection with the production of crease-resistant finishes. Although a large number of patents have been obtained for the use of synthetic resins in this connection, the method chiefly used in this country is that covered by the patents of Tootal Broadhurst, Lee & Co. Ltd., viz. the urea-formaldehyde process, which depends upon the formation in the cloth of a urea-formaldehyde condensate. Since the mere application of a fabric of fully polymerized synthetic resins does not result in a crease-resistant effect, the necessary condensate has to be formed by suitable treatment of the fabric carrying the necessary components. Briefly the effect is achieved by heat treatment of a fabric carrying a partially condensed urea-formaldehyde resin in presence of a suitable catalyst.

The whole process from original impregnation of the fabric with the resin components to the final washing-off, which removes free or surface resin, calls for a careful adjustment of operating conditions and control, but, when correctly applied, a truly durable crease-resistant finish results. The process is capable of application to a wide variety of fabrics, the most satisfactory results being probably obtained on spun viscose rayon, although other cellulosic fibers give very satisfactory results. Linen gives satisfactory results, provided that the treated fabric is afterwards mercerized; without this after-treatment, loss in strength and a thin brittle fabric result.

Following upon the crease-resistant process and also employing synthetic resins, there appeared the methods covered by the patents of the Calico Printers' Association, Ltd., Lantz and others, for the production of embossed styles fast to washing or other wet processes. As mentioned earlier, embossed styles have been marketed for many years, but have suffered from the defect of being wholly or in part destroyed by wet processing, or, in other words, they lacked durability. It has now been shown that by treatment of fabrics with aqueous solutions of partially condensed resins, followed by treatments to complete the condensation, either generally throughout the material or in localized areas, preceded or followed by embossing, durable wash-resisting embossed styles can be produced.

Metallic powders and suitable pigments incorporated in synthetic resins and applied to fabrics by printing, produce novel and durable effects, and these applications illustrate briefly the growing use of synthetic resins in textile finishing, although mention should be made of their use in the production of "oiled silk" effects.

The comparatively recent introduction of Trubenized fabrics has aroused considerable interest. The method of bonding two layers of fabric by the Trubenizing process depends upon plasticizing the cellulose acetate component of a cotton-cellulose acetate interlining fabric, by passage through a mixture of acetone and methylated spirit. The plasticized interliner, by means of heat and pressure, is then caused to adhere to the two outer layers of facing material and by this means a bonded fabric with good adhesion is secured. Trubenized fabrics retain their adhesion in and after laundering, but disadvantages in the process are apparent. Whenever organic solvents are employed there is a distinct fire risk and, in addition, the process imposes certain limitations upon the dyer, since the solvent action of the mixture calls for care in the selection of dyes used on fabrics which are to be afterwards submitted to the Trubenizing process.

In order to overcome these defects, synthetic resins have been developed for use in producing bonded fabrics. It has been found possible to prepare suitable synthetic resins which are capable of application to a cotton interlining fabric from aqueous emulsions. By this means the fire hazard is eliminated and, in addition, bonding is carried out after the interliner has been dried, so that a cleaner and more convenient process can be operated. The choice of resin for this process calls for some care in selection, since, above all, a "tinny" handle should be avoided, the bond should withstand laundering, and tendering and discoloration of fabrics should not take place.

Another important development in the class of finish under consideration is the group of finishing agents based upon cellulose ethers. It has been the practice for a considerable time to add weight, and improve the appearance and handle of fabrics, by the application of starch, gums, mineral fillers, etc. As mentioned previously, however, such effects are impermanent. For example, in a case recently encountered, 88 per cent of the added weight was removed by one laundering of a fabric filled with starch and china clay. The alkali-soluble cellulose ethers, on the other hand, possess properties which enable heavily filled finishes to be produced which will resist washing, i. e. they may be regarded as durable. Water-soluble cellulose ethers are also available; they give finishes intermediate in durability between those given by starch and by the alkali-soluble ethers.

The alkali-soluble compounds have a low alkoxy-content and are soluble in 5-7 per cent caustic soda solutions, but are insoluble in water, acids or solutions of alkali carbonates. They are applied to fabrics, therefore, from a caustic soda solution and, on passage of the impregnated fabric through a bath of acid or a solution of certain electrolytes, e. g. ammonium sulfate, the cellulose ether is precipitated upon the fabric. One product, for example, yields both plain and filled durable finishes, since the ethers have excellent binding properties for mineral fillers. The alkali-soluble cellulose ethers may be applied to mercerized or plain cloths, and back-filled styles, buckrams, shirtings, bluettes and sheetings are amongst the

(Continued on page 628)

PROCEEDINGS OF THE

American Association of Textile Chemists and Colorists

OCTOBER 31, 1938

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Special Round Trip Fare To Atlanta

BEFORE canceling fifteen-day round trip rates generally in September, the Southern Railway System made a special extension to cover the Annual Meeting of the Association in Atlanta. Tickets will be sold at ticket offices in New York and southward, to those stating that they are attending the Annual Meeting. In New England they must be purchased directly from the Southern Railway System, 185 Devonshire St., Boston. They will be on sale from November 28 to December 2, inclusive, bearing final limit for return fifteen days from date of sale, and permitting stop-overs at all points.

The reduction applies between Washington and Atlanta, making round trip fares as follows:—

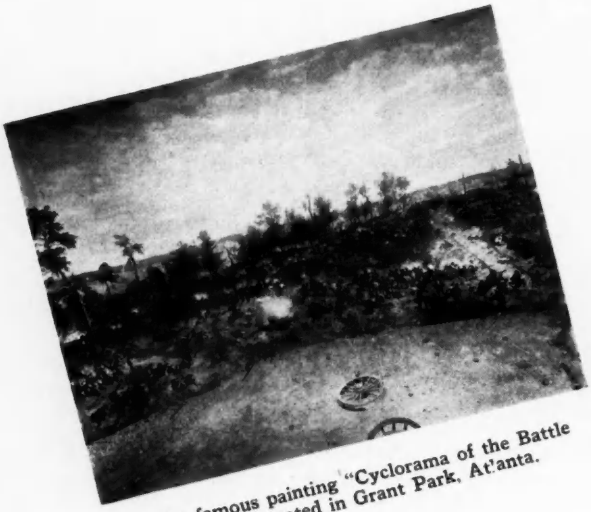
Boston, $57.75; Providence, $55.15; New York, $42.15; Philadelphia, $36.75; Washington, $28.75. A lower berth, one way, from New York is $6.85; from Washington, $5.25.

Following are train times, Central Standard for Atlanta, and Eastern Standard for other points:—

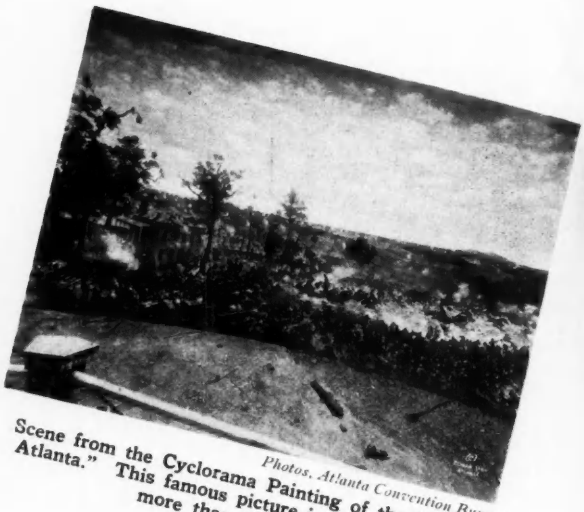
Leave Boston	10:35 PM	9:00 AM	12:00 M	4:00 PM
Leave New York, Penn Sta.	9:30 AM	2:25 PM	7:30 PM	9:45 PM
Arrive Washington.	1:25 PM	6:25 PM	11:40 PM	2:10 AM
Leave Washington .	1:40 PM	6:45 PM	11:59 PM	3:00 AM
Arrive Atlanta	6:00 AM	8:35 AM	3:30 PM	5:40 PM
Leave Atlanta	11:55 PM	8:25 AM	1:00 PM	6:10 PM
Arrive Washington.	7:25 PM	1:40 AM	4:50 AM	11:20 AM
Leave Washington .	8:00 PM	2:10 AM	5:05 AM	12:00 M
Arrive New York.	12:15 AM	6:55 AM	9:15 AM	4:00 PM
Arrive Boston	7:45 AM	3:00 PM	3:00 PM	10:00 PM

ANNUAL MEETING

In Historic Atlanta



View of the famous painting "Cyclorama of the Battle of Atlanta." Located in Grant Park, Atlanta.



Photos, Atlanta Convention Bureau

Scene from the Cyclorama Painting of the "Battle of Atlanta." This famous picture is visited annually by more than 100,000 people.

Atlanta, setting for Margaret Mitchell's famous novel, "Gone With the Wind," has an historic background which will be of interest to delegates and visitors attending the National Convention.

The world famous panorama painting of The Battle of Atlanta is housed in the Cyclorama Building in Grant Park. The painting, measuring fifty feet in height, four hundred feet in circumference and weighing eighteen thousand pounds, was painted in 1885 and 1886 in Milwaukee by three German artists, Lohr, Lorenz and Hiene. Eight thousand pounds of paint was used in the production of this painting whose landscape, looking in any direction from the reviewers' platform, covers a radius of twenty-five or thirty miles. So realistic and so unmistakably true is this landscape that one familiar with Atlanta may point out many individual places.

Also of interest are The Wren's Nest, the home of Joel Chandler Harris, creator of "Uncle Remus"; the only exact replica of Bobby Burn's cottage in America; and Stone Mountain, which is a natural wonder, being five feet taller than the Woolworth Building. Twenty miles away at Roswell is Bullock Hall, ante bellum home of Mittie Bullock, mother of Theodore Roosevelt, and looking very much as it did when she left it, the bride of Mr. Roosevelt. Twenty miles in another direction are Marietta and Kennesaw Mountain, scene of one of the fiercest battles of the War between the States. The battlefield has been dedicated as a national park.

DECEMBER 2ND AND 3RD

Headquarters:—Atlanta Biltmore Hotel

GAND CONVENTION

Golf in Atlanta

Left: Bobby Jones; right, Charlie Yates

Scene at East Lake Country Club

Golfers attending the National Convention in Atlanta, December 2nd and 3rd, will have an opportunity to play the home course of Bobby Jones and Charlie Yates, past and present Kings of Golf. The beautiful East Lake Country Club, with its two 18-hole championship courses will be open to visitors and A.A.T.C.C. members. Atlanta boasts a total of nine private golf clubs and five municipally owned courses, all of which will welcome visitors attending the Convention.

RD ATLANTA, GEORGIA

Auspices: Southeastern Section

Notes on the Fastening to Water of

Union Dyed Fabrics*

E. S. CHAPIN**

I AM reminded of an incident narrated by Mark Twain in his story, "A Connecticut Yankee at King Arthur's Court." The Yankee was in the dining hall sizing up the knights and ladies and all the new sights, when a slip of a youngster in a striking costume strolled toward him. "And what are you," asked the Yankee curiously. "Oh" replied the youth with a pert shake of the head, "I'm a page." "Get out," said the Yankee, "You aren't even a paragraph."

The paragraphs or pages from our note book concerning the fastening to water of union dyed fabrics do not go back to King Arthur but they do go back quite a bit in time.

For the benefit of those in the audience who are not familiar with the fastening to water of union dyed goods, I have brought up an exhibit. This is part of an exhibit that we took down to the Patent Office to illustrate the process.

The dyeing of direct colors on cotton or union goods is a reversible reaction. In dyeing, the dye is precipitated from water solution on the fiber. After dyeing, if the goods are immersed in fresh water the reverse takes place; the dye comes off the fiber and goes back into solution. Fixing prevents this.

This is illustrated by the exhibit. This (holding up a bottle) is a water immersion test of a union dyed blue. The blue has bled back into the solution until it is opaque. The same dyeing fixed and then tested gives a water white result.

Here is a brown: unfixed and fixed—same comparison.

Here is a red: unfixed and fixed.

Here is a green: unfixed and fixed.

Those near enough to read the legend on the bottles will note the date, October 6, 1936: so that the pieces have been immersed in water for one year and seven months.

Another test is the wet-hot pressing test: placing the dyed goods between wet white cotton goods and ironing dry.

This is the wet-hot press test of the unfixed union dyed blue. Cotton stained considerably. And this is the test of the fixed blue: cotton white.

Here is the brown: fixed and unfixed—same comparison.

Here is the red: fixed and unfixed.

Here is the green: fixed and unfixed.

Those near enough will be able to note that the shades of the unfixed and fixed dyeings are practically the same.

Some years ago the query came into our laboratory whether it would be possible to make a union dyed fabric fast to steeping in water.

It occurred to us that a water fast result could perhaps be secured by mordanting the goods with Chrome Salt D and dyeing with mordant colors. Chrome Salt D had been used extensively during the war period as a mordant for cotton in the dyeing of blue, brown, and khaki.

On mordanting the union goods from the mill with Chrome Salt D and dyeing with Anthracene Blue, a result was indeed secured fast to steeping in water: but the cost was prohibitive.

The cost was then reduced: first by decreasing the percentage of the mordant; and secondly by using instead of the expensive Anthracene Blue ordinary cheap union dyes.

Chrome Salt D is a complex compound of chromium, approximately chromium dioxide, which mordants more rapidly and energetically than bichromate of soda or any of the usual chromium products of the trade. It gives a ground on which direct colors can be dyed in a salt bath fast to water. Once the direct dye is deposited on the mordanted fibers it is fastened to water and does not wash off in subsequent rinsing.

Another factor in dyeing union goods is that the mordant on the wool acts as a partial resist toward direct colors. The direct colors tend to dye the cotton by preference even at the boil. This gives a rich cotton and prevents over dyeing the wool.

Chrome Salt D mordants mixed goods readily and quickly, even below the boil. As low a temperature as 120° F. can be utilized. The time of mordanting can be reduced until it amounts virtually only to that required for feeding the mordant to the bath and ensuring its uniform deposition on and penetration into the fabric.

Chrome Salt D. mordants so energetically, especially the woolen fiber, that if used alone it tends to produce a crock. Accordingly solubilizing and retarding agents are preferably included in the mordanting. A typical formula for mordanting is:

3% Chrome Salt D
2% Chrome Salt Assistant C
5% Acetic Acid (28%)

*Presented before Northern New England Section, May 6, 1938.

**Associate of W. C. Durfee Co., Inc., Boston, Mass.

Chrome Salt D can be used with advantage in the coloring of a wide variety of union materials, composed variously of wool, cotton, rayon, silk etc., especially in heavy shades where it is required to have a rich shade on the cotton. Mixed materials containing cotton and tussah silk fibers and specks, almost impossible of coloring by the ordinary union process or by speck-dyeing, can be dyed uniformly and fast to water by the Chrome Salt process.

A peculiar incident led us to investigate the fastening to water of union dyeings by aftertreatment. In seeking to reduce the cost of dyeing by the Chrome Salt process and especially in trying to reduce the percentage of the mordant, we found a point below which the resulting dyeings were not fast to water. This was especially noticeable with heavy shades of direct dyes, difficult to fix, as heavy navies with a component of Blue BH. The thought occurred to overcome this deficiency in water fastness by an aftertreatment in connection with the final salt rinse. From this it was but a step to study the value of aftertreatment in and of itself.

All the water soluble metallic salts fix direct dyes to a greater or less degree, the potency of fixing corresponding roughly to the valence of the metallic base or cation. The salts of monovalent cations, as sodium chloride fix only to a slight degree; the salts of bi-valent cations, as copper sulfate, fix more readily; and most potent in fixing are the salts of trivalent and poly-valent cations, as aluminum and titanium sulfates. Acids fix in varying degree: and also salts of organic bases, as salts derived from diphenylamine. Alkalies are inimical to fixing.

Two other considerations besides potency of fixing enter into the choice of the fixing agent, viz. freedom from throwing the shade and the effect on the strength of the vegetable fibers.

The throwing of shade is well illustrated by the aftertreatments of direct dyes with copper sulfate. The greening of Blues 6B and R W by copper sulfate aftertreatment is well known: as also the very considerable changes of shade caused by this aftertreatment of various direct browns.

The tendering of vegetable fiber is well illustrated by what happened when we experimented with stannic chloride. I asked the laboratory assistant where the result was and he replied, "It all burnt up in drying and the wind blew away the ashes." Manifestly, stannic chloride is not to be recommended as a fixing agent!

The well nigh universal rejection of straight alum as a fixing agent is primarily because of the inevitable danger of tendering vegetable fiber.

The application of two principles will enable the use in aftertreatment of metallic salts which are potent fixing agents but which used of themselves and unmodified throw the shade and tender vegetable fibers. We will call these principles: acid binding and shade balancing.

We will consider acid binding first, as it is relatively more important. Change of shade can be allowed for in dyeing: but once the goods are tendered, nothing can be done about it.

Acid binding may be accomplished in two ways. First, by neutralizing or reducing the acidity of the fixing agent by alkalies or alkaline carbonates: and secondly by changing the nature of the acidity of the fixing solution from that of strong acidity, as of sulfuric acid to weak acidity, as of acetic acid, by the use of acetates.

Shade balancing is more novel. This audience is quite familiar with bringing dyeings to shade by toning. Shade balancing is somewhat different. It is more akin to the principle of mixed mordants. The toning preparation is in advance. Thus, if it is known that aluminum salts in aftertreatment tend to brighten the dyeings of certain direct dyes and that the same dyeings are saddened in aftertreatment by chromium salts, then a blending of aluminum and chromium salts in proper proportions will produce a fixing composition in which there will be a minimum of shade change in the aftertreatment, as the opposing colorimetric tendencies will neutralize or balance each other.

The preferred fixing compositions or salts are composed of a potent fixing agent, blended with proper proportions of acid binders and shade balancers. A typical Fixing Salt is made up as follows: using for a potent fixing agent, an aluminum salt; as an acid binder, an acetate; and as a shade balancing agent, some form of chromic salt. Inclusion in the formula of a certain proportion of solubilizing and retarding agents, as bitartrate of potash, is considered to facilitate desirable properties as evenness, penetration, and freedom from crock.

Finally, the fixing process is not complete without the inclusion in the formula of the grand old wheel horse of dyeing, common salt. It has been found that the use of approximately twice as much salt as fixing salt is conducive to best results.

The process of aftertreating with Fixing Salts is simple. In contrast to many previous aftertreating methods, carried out at high temperatures, 140°-160° or higher, the process of aftertreating with Fixing Salts is a low temperature process. 70° F. is a suitable temperature though a higher temperature may be employed and is preferable for goods difficult to penetrate. The well washed dyed goods are run in a salt bath for a few minutes, then the solution of the Fixing Salt is added, and the running continued for twenty minutes. Washing after fixing depends on the nature of the fabric and the nature of the Fixing Salt.

The principal difficulty in aftertreatment is the change of shade: which reminds me of the story of the negro, whose boss bawled him out because his clothes looked so bad. "Well, you see, boss, it's this a way," said the darky. "You don't pay me much: so when I'se saved

enough money to buy a pair of pants, my coat is all wore out; and when I'se saved enough money to buy a coat, the pants is all wore out; and I *never can* save enough to buy a whole new suit."

And so it is with aftertreatments. Some aftertreatments fix but change the shade: others preserve the shade but don't fix.

The preferred fixing salts, compounded on the principles described, solve the difficulty: they both preserve the shade and fix.

Further data and details concerning the Chrome Salt process and the process of aftertreatment with Fixing Salts can be found in United States patents recently issued.

Factors Contributing to Detergency —

"What Makes a Soap?"*

DR. L. P. HALL**

INTEREST in detergency has recently increased, due, without doubt, to the hope that some of the new synthetic detergents will overcome or eliminate some of our present difficulties in using soap. One worker in this field recently made the statement that of the several thousand compounds which have been patented as wetting agents, emulsifying agents, and detergents, only about one per cent were really effective in detergency.

WHAT IS DETERGENCY?

This statement immediately raises the question—what are the factors contributing to detergency and what is a detergent? These terms, very loosely used in the past, usually refer in a broad sense to the removal of extraneous matter, whatever the nature of this foreign matter may be. A detergent may be defined as a "cleansing agent used to free a surface or a material from dirt, soil, filth, or any other unwanted substance." The term detergent, therefore, should include all such agents as the soluble soaps of fatty acids, the newer synthetic soaps, alkaline cleaners, and even bleaching agents, insofar as they assist in the removal of undesired substances.

Textile practice requires many types of detergent action. As typical examples of removing "unwanted substances" there may be listed such operations as—

1. Desizing, in which starch and other sizing agents are removed.

2. Kier boiling, in which waxes, dirt, and other materials are removed.

3. Wool scouring, in which grease and many types of soil are removed.

4. Degumming or boiling off, in which ceresin is removed from silk.

5. Soaping off after dyeing to remove unattached dye.

However, one usually associates detergency with such every-day processes as laundering or dry cleaning of clothes or fabrics. Here many types of soil may be encountered. Body soil may consist of dust, clay, carbon, or other solid soils bound with greasy or oily material and protein material, such as dead cells, excretions from glands, etc., food stains, and so on.

This list of cleaning problems indicates the many-sided problems encountered in a study of detergents. It is necessary to consider not only the detergent itself, but a multiplicity of factors, including the nature of the surface to be cleaned, the nature of the soil to be removed, the action of the detergent and its solution on the surface or material being cleaned, the effect of the solvent on the detergent, including the effects of acid and hard water, etc.

TYPES OF SOIL

For purposes of simplification and generalization, it is convenient to classify the various sorts of dirt or soil under three general headings: (a) oily or greasy soil, (b) solid soil, and (c) special types of soil, such as starch, protein, and stains. Frequently, in detergent problems, all three types are encountered at once, or a mixture of two types.

The first two types of soil are usually the only ones considered in most theories of detergency. The usual statement in regard to removal of such soils is that after the initial wetting of the material and the soil thereon has occurred, emulsification of the grease or soil takes place and deflocculation follows.

*Presented before Phila. Section, April 22, 1938.

**Research Chemist of Röhm & Haas Co., Inc., Phila., Pa.

There is one generalization which can be profitably made for an understanding of detergency. *The effect of the detergent on insoluble soil is to change the nature of the surface of the soil from one which is indifferent to water or from one which repels water, to one which is attracted to water.* To obtain the full meaning of this generalization, it is necessary to discuss the types of action by which soil is removed and the function of the detergent in bringing this about.

FACTORS CONTRIBUTING TO DETERGENCY

The principal effects of detergents to be considered are

Wetting, of soil
of fabric
Penetration
Emulsification
Deflocculation

Secondary effects which need to be taken into account include:

Adsorption
Lubrication of fibers
Solution
Hydrolysis
Oxidation
Saponification

The variety of effects shown in this list (which is by no means complete) shows that many factors must be considered in detergency, and emphasizes the fact that the study of detergency is not as simple as it would at first appear.

In the examples cited above, *wetting* always plays a part, and *penetration* is usually of importance because the soil is held in pores and interstices as well as on the outer surface of the material. Penetration is of particular importance to the laundryman who must remove ground-in grime from pillowcases, neckbands, and cuffs, or to the dyer, who desires thorough soaping off. *Emulsification* undoubtedly plays a role in soil removal of oil or grease. But emulsification without *preferential wetting,* as we shall show, does not yield a really clean fabric or surface. *Deflocculation* of solid soil,—that is, the removal, dispersion or peptization, and suspension of solid soil is of prime importance, not only in every-day laundry practice, but in the removal of loose or unattached dye.

ADSORPTION

Before discussion of the main types of action in more detail, some of the secondary effects should be mentioned. Adsorption is highly important, because adsorption is the basis of the action of any detergent whether it is used for wetting, emulsifying or deflocculating. Adsorption determines, in part, the finish imparted by the detergent. Adsorption also determines the quantity of detergent which is required. High adsorption rapidly exhausts a bath

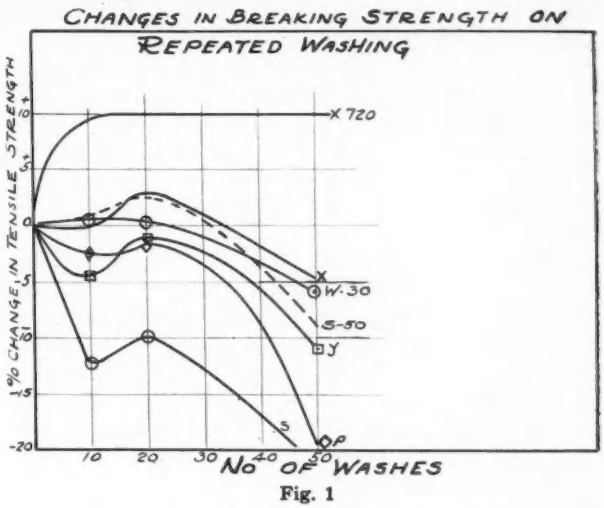


Fig. 1

and greatly increases costs. When a detergent is too highly adsorbed, it is not effective in low concentrations and much more detergent must be used to give the effect expected. Low adsorption gives the most economical detergent.

Deposition of soap or detergent on and among the fibers may influence tensile strength. If there is no deterioration of the fibers due to the detergent, breaking strength usually improves after a few washings because of more even tension among all fibers and strands. Excessive lubrication gives a fiber slippage which results in a loss of strength. Figure I illustrates the influence of adsorbed soaps on breaking strengths.

SOLUTION, HYDROLYSIS AND SAPONIFICATION

Solution of soluble soil is a definite part of many cleaning processes. Grease-borne stains are dissolved in dry cleaning. Oil stains on fabrics are frequently removed by using a strong soap solution which dissolves away the grease. Salts, sugars, dextrin, and the like, are removed by aqueous solution and diluting the wash water.

Hydrolysis, along with solution, helps remove starch sizings. Every mill man today is familiar with the powerful solubilizing action of *enzymes,* which completely hydrolyze starch without harming the fabric. Acid and alkali also hydrolyze starch, but not without the liability of attack of the fibers.

Oxidation may play a part in solubilizing starch and in the chlorine bleach starch is degraded by oxidation so that it may be then washed away. Other materials, particularly certain stains, may be solubilized so that the extraneous material may be washed away.

Saponification occurs when strong alkalies are used on greases or waxes. If free fatty acids are present, soaps are formed directly, and these fatty acid soaps, formed in

situ, are unusually effective. This saponified grease may help emulsify the rest of the grease present.

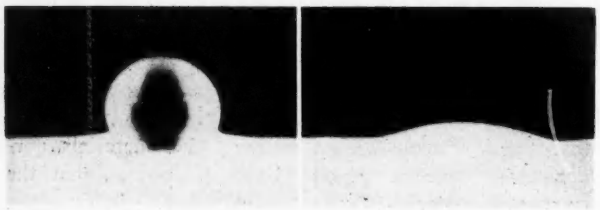
It will thus be seen that the processes of hydrolysis and saponification are directly connected with the process of solution, and these types of action should be considered together. These processes are particularly important in desizing, kier boiling, boiling-off silk and scouring wool.

EVALUATION OF DETERGENTS

The principal types of detergent action—wetting, penetrating, emulsifying and deflocculating—have been discussed from time to time in the past. It has been claimed by several research workers that detergents could be evaluated by considering interfacial tensions, but with one exception, there does not seem to have been any effort to establish any actual relationship between detergency and interfacial tensions. Several other workers have based their whole theory of detergency on deflocculation, but once again, no effort was made to establish whether or not there was an actual relationship between deflocculation and soil removal. Until recently, little scientific thought had been given wetting, and still less thought given to penetration.

On the other hand, various groups had turned to wash tests as a means of evaluating detergents. One group in particular had been conspicuously successful in developing methods for making standard soiled fabric, for running wash tests, and for determining the results of repeated washing, in terms of soil removal efficiency, whiteness retention, effect on dyed fabrics, changes in breaking strength, etc. This group, under Dr. Pauline Beery Mack at the Pennsylvania State College, had been able to determine the efficiency of laundry procedures and had been using this method for a period of years for the routine control of certified laundries in Pennsylvania.

In a quest for the best means of studying detergents and wetting agents, we naturally turned to Dr. Mack's methods and have attempted to correlate practical results from wash tests with physico-chemical data. Much of the data discussed here tonight was obtained in Dr. Mack's laboratory, and the details of these experiments will be published from Dr. Mack's laboratory. It will be sufficient for the purposes of this discussion of detergency to report the general facts which were obtained from this research project.



a. Drop of Water on Wax Surface. b. 0.5% W. 30 Solution on Same Wax Surface.

Fig. 2

We shall now proceed to examine the main types of detergent action.

WETTING

When a drop of water is placed on a waxy or oily surface, it tends to draw up into a small globule. If a trace of a surface-active compound of the right sort is added to water, it is found that instead of the water forming a round droplet, it tends to flatten out on the oily surface. If the surface-active material is present in sufficient amount, and if it is sufficiently powerful, the solution tends to spread over the surface. See Figure 2.

The tendency of solutions to spread on a surface may be evaluated by means of "spreading coefficients," which depend upon the surface energies involved. Now unfortunately, we do not know how to measure surface tensions of solids or interfacial tensions between solids and detergent solutions. But there are several ways of approaching an evaluation of this sort and of making approximate evaluations.

It is sufficient to state here the general rules which control spreading wetting, as we have just described it. The rules are most conveniently presented as algebraic summaries.

Let F = spreading coefficient
S = surface tension or interfacial tension for *s* solid, or *l* liquid or *o* oil or *ls* liquid to solid, etc.
A = adhesion tension
$\cos \Theta$ = cosine of angle of wetting

Then $F = A\ S_l$
or $F = S_s - S_{sl} - S_l$
or $F = S_l (\cos \Theta - 1)$

From these equations it may be seen that *low* surface tensions tend to give larger values of F, the spreading coefficient. F may be a negative number or a positive number, but the less negative it is or the more positive, the greater is the tendency of the liquid to spread.

The same sort of rule applies to spreading oil on a surface. For detergency to occur, however, we find that the tendency of the oil to spread must be less than the tendency of the solution of detergent to spread.

Now, if the oil and detergent solution are present together on the same fiber, the rule which controls what happens may be stated as follows:

$$\text{Cos } \Theta_{ol} = \frac{S_l \cos \Theta_{ls} - S_o \cos \Theta_{os}*}{S_{ol}}$$

*Note: Subscripts refer to solution or liquid (1), solid (s) and oil (o).

This equation shows that surface tensions of the detergent solution and of oil both determine the outcome, as well as the interfacial tension and the angles of wetting. For a good detergent against grease, $\cos \Theta_{ol}$ must be positive and as large as possible. Thus, preferential wetting determines the removal of grease from a surface.

While wetting is still the main subject of discussion, it

may be stated that there does not appear to be any consistent relationship between wetting-out time and detergent value. Compare Table I. In a given series of compounds, it is often true that the most rapid wetting-out agent may be the poorest detergent. Wetting-out generally includes not only pure wetting, but also penetration.

Figure 3 shows the importance of low interfacial tensions in relation to soil removal.

TABLE I

Comparison of Soil Removal Efficiency and Wetting-out Time (Draves' Method)

Compound	*W.O.T.*		*Contact Angle on Paraffin*		*S.R.E.*	
	1 *g./L.*	1.5 *g./L.*			10 *Washes*	50 *Washes*
	Seconds		*Min.*	0.1%	%	%
Y	250	77.5	41	43.5	23	38
X	150	27.1	46	58	16	41
S.51	...	24.4	37	39	14	40
S.50	...	16.3	..	..	17	44
W.30	29	15.0	16.5	36.5	12	30
720	19	11.0	34	44	27	45

Low values for Wetting Out Time (W.O.T.) indicate a compound with powerful wetting action. High values for Soil Removal Efficiency (S.R.E.) indicate good detergency. Incidentally, best present laundry condition on this soil would give a value of 40 for fifty washes. Contact angles alone do not show which compound will be the most rapid wetting agent or the most efficient detergent.

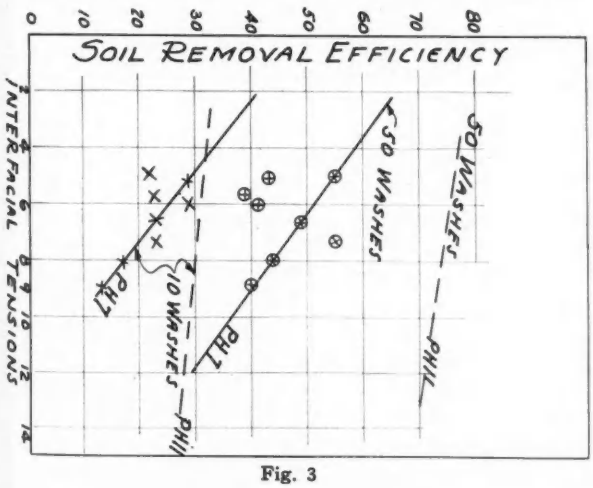


Fig. 3

PENETRATION

In order to remove soil from pores and spaces in and between the threads and fibers, the detergent solution must penetrate the fabric to be cleaned in order to reach the soil and surround it The general rule which such action follows may be derived from Poiseuille's law of viscous flow, and is conveniently summarized as follows:

$$\frac{dl}{dt} = \frac{1}{4}\,\frac{S}{v}\cos\Theta\,\frac{r}{l}$$

where l = distance of penetration, t equals time, r the radius of the capillaries, v the viscosity, etc. The term dl/dt represents the *rate* at which a solution passes through the capillary spaces in fabric. It will be seen that as large a product of S (surface tension) times cos Θ (the cosine of the angle of wetting) is desired as possible for penetration. For large values of cos Θ, S must be low, and so the final result depends upon a balance of factors.

In actual tests, cloth never gives quite the penetration one might expect from the equation above. The better agents approach the conditions given by the above equation; the poorer agents deviate considerably. The reasons for these deviations are to be found in rates of orientation and adsorption, in rates of diffusion of the detergent micelles, and in effect of the agents on fiber swelling.

In fiber swelling studies, it has been found that the rate of swelling and the degree of swelling depend in part upon the nature of the detergent. When too great swelling occurs, penetration is poorer, indicating a closing up of capillary spaces. Moderate swelling yields the optimum results.

The penetration of fabric requires usually the displacement of air trapped in the capillaries in, between and among the fibers. This may also be a factor which prevents the rate from reaching the full value to be expected from laboratory data.

EMULSIFICATION

From our earlier discussion, it is evident that it is believed that emulsification is important in the general detergent process. It is probably true that some compounds remove grease or oil entirely by emulsification, but it seems more likely that the more powerful detergents depend for their effect on the removal of grease by preferential wetting, with subsequent emulsification of the grease. Those detergents which emulsify grease directly may leave fabrics with poor whiteness. The net effect of such detergents is to coat all the fabric evenly with the finely divided soil. This is undoubtedly one cause of the much advertised "tattle-tale grey."

The ease of emulsification—either directly from the fiber or after grease has been displaced from the fiber—depends upon the lowering of the interfacial tension by the detergent. Apparently, values of interfacial tension less than about 11 dynes per cm. are necessary in detergents to get emulsions when adequate mechanical action is applied. With values as low as 1 or 2 dynes per cm., emulsions may be formed almost spontaneously even without stirring. It should be noted that the interfacial tensions have to do with a detergent's ability to form emulsions, and do not determine *stability* of emulsions.

There seems to be a practical lower limit to interfacial tensions as well as an upper limit. If the value is too low, the detergent itself is highly adsorbed, requiring an excessive amount of soap or other detergent. This increase

in adsorption is connected with the phenomenon of interfacial tension lowering and also with the fact that finer particles are usually produced in the emulsion, causing a large increase in the particle surface which can adsorb the soap.

DEFLOCCULATION

The mechanism of removing solid soil differs in part from that of removing liquid grease. It is similar in that the solid soil must be displaced from the fabric. But it must be dispersed and suspended so that it is not redeposited.

The best detergents in general have high dispersing and high deflocculating powers. It does not seem possible, however, to show a linear relation between the two and soil removal efficiency. This much can be said—that for good soil removal of solid soil, high deflocculating power is essential. Pure white fabrics also seem to depend in part upon good deflocculation.

Many of the newer detergents seem to be lacking in deflocculating power. This accounts for their relatively poor value against solid soil. It is possible, on the other hand, to make some synthetic compounds which are better than fatty acid soaps in deflocculating. The few compounds which behave thus provide a new potential or a new source of power to remove solid soil.

Deflocculating power is characteristic of the detergent and also of its concentration, thus allowing control of this sort of detergency.

Both deflocculation and emulsification are much influenced by changes in pH values. This is due in part to the change in micellular condition of the soap, and in greater part to the increased negative charges on soil and on the surface to be cleaned.

Figure 4 shows that soil removal in general improves with increasing deflocculation and dispersion.

THE CHOICE OF AGENTS

It is not expected that every mill chemist will wish to run every sort of test to which reference has been made. The manufacturer of wetting agents and detergents, however, must consider all these effects of detergents—and more—if he is to produce and market useful agents. Such information is essential in choosing the best compounds for various purposes. Knowledge of the ways in which these compounds act permits evaluation of compounds for the specific job which is to be done, and therefore, the most economical choice of the detergent or wetting agent to be used. It does not seem to be a correct procedure to choose a compound on the basis of, let us say, penetration alone, when the job to be accomplished is the removal of solid soil.

It is suggested that the choice of wetting agent or detergent be made after a careful analysis of what is to be accomplished and on the basis of the types of action which are needed to accomplish the correct result in the most satisfactory fashion. The economic considerations

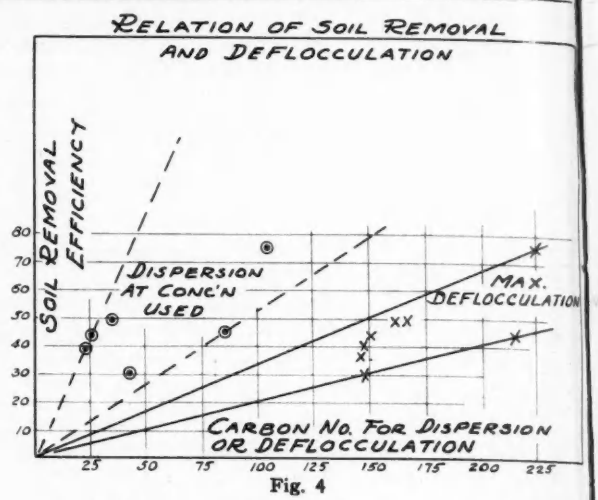


Fig. 4

must include not only the efficiency of agents for given types of action, but also the amount of agent needed and the rate at which this agent will be used up through adsorption. In other words, it seems logical to test and evaluate wetting agents and detergents for the purposes for which they are actually to be used, with due consideration for any side effects. The tests used should be parallel and related to the removal of the particular type of soil at hand.

While there are various means of evaluating detergents for individual properties, there appears to be only one way to obtain an over-all appraisal of properties, and that is by means of the carefully standardized procedure consisting of running fifty wash tests on a carefully standardized soiled fabric.

MEETING, MID-WEST SECTION

A MEETING of the Mid-West Section was held at the Bismarck Hotel, Chicago, Ill., on Saturday, October 8, 1938.

Dinner was served at 7:30 PM. Eighty-one members and guests were present.

The meeting was called to order at 8:30 PM by Chairman E. J. Siegrist. The minutes of the previous meeting and outing were approved. The Treasurer's report was also read by the Secretary.

Arthur Brainerd spoke to the members about attending the annual meeting to be held at Atlanta, Georgia, on December 2nd and 3rd, 1938, and hoped our section would be well represented at that meeting.

The speaker of the evening was Lloyd O. Koons of Scholler Bros., Philadelphia, Pa., whose subject, "Newer Textile Agents in Dyeing and Finishing of Textile Fabrics," was well received.

There being no further business, the meeting was adjourned at 9:45 PM.

Respectfully submitted,

HERBERT W. TETZLAFF, *Secretary.*

Additive Effect of Builders in Detergency*

J. FRED OESTERLING**

I WOULD like to introduce my brief remarks on the additive effect of alkaline builders in detergency by quoting a paragraph from a friend of mine in the laundry trade, M. P. Burlingame, who recently had this to say on "The Laundry Industry":

"The restoration, to a condition of cleanliness, of wearing apparel and fabrics, which have been worn or used, is one of the most persistently recurring and one of the oldest of tasks which always has and probably, always will confront civilized mankind.

"Indeed it might be facetiously alleged that the origin of this task goes back to that memorable day of catastrophe in the Garden of Eden when our original ancestors celebrated the first of the 'eat-more-fruit' days, thus starting many unexpected and disagreeable sequences which have harassed and worried their descendants ever since. Among these were clothes. The necessity of preserving them and keeping them fit to wear by periodical cleaning doubtless was soon apparent."

Many of the members here tonight are primarily interested in the production of textile fabrics which are to be made into clothing, household fabrics, and other textile goods. The restoration of textile fabrics is quite as important as their production, however, and thought should be given during each step of the manufacturing process to the launderability or drycleanability of the product, so that it may give the maximum of satisfaction to the ultimate consumer.

Inasmuch as laundry research happens to be my particular field of interest, I will stay in my own back yard and discuss a problem of considerable interest in the laundry. In discussing this subject I hope that each of you may find at least some remote connection between this and your own particular field of interest.

The job of the commercial laundry begins where that of the textile mill and the textile chemist and colorist leave off. The laundry industry in this country is about 100 years old. During its early development, laundering processes were carried on more or less by "rule-of-the-thumb" method, as is the case with many new industries. As is common with many new small industries, each individual plant had its own secret formulas. We know now that these secret processes were quite common to the entire industry, each laundryman believing that the secret was strictly his own. Today commercial laundering consists of well organized and scientifically controlled processes, and various state organizations, and one national organization of power laundryowners are carrying on excellent cooperative research programs.

The task of the commercial laundry is to restore soiled fabrics to a state of newness by removing the maximum amount of soil, dirt, and stains with a minimum change in the color, size, and strength of the laundered articles. The success of the laundry in doing this depends upon two things: first, the launderability of the fabric, as dependent upon its structure; and, second, the procedure used in washing the textile material.

Briefly, a good power laundry washing procedure consists of placing soiled fabrics in cotton nets which in turn are put into a washwheel. The washwheel is made up of a revolving cylinder within an outside cylinder, or shell, which is stationary. The inside cylinder rotates first in one direction, then in the opposite. Eight revolutions in one direction is about the maximum which any washwheel makes before reversing. The mechanical action, which is necessary for soil removal, is essentially a mild tumbling process. Each load of soiled clothes is given from three to five ten-minute soap and alkali baths in four to five inches of soft water. During the last of these a bleaching agent, such as sodium hypochlorite, hydrogen peroxide, or sodium perborate are usually added to the last suds bath. This is followed by rinsing in four to seven changes of soft water. An organic acid or an acid salt, called by the laundryman a "sour," together with blueing, or a blue, may be added to the last or next to the last rinse depending upon the type of work being handled. Temperatures of the baths are adjusted according to the type of fabrics being washed. For example, in the processing of colored cotton or linen, in which the colors might run, the temperature of each individual washing step should not exceed 100° F. For white work, the washing temperature may reach a maximum of 170° F., although no temperature higher than 160° F. is recommended for the bath in which soaps and alkalies are selected according to the kind of fibers and type of fabrics which are to be washed.

While soap is one of the best detergents known for commercial laundering, soap to which alkaline builders have been added are found to be much more effective. It

*Presented before Phila. Section, April 22, 1938.

**Research Fellow of The Pennsylvania Laundryowners, The Pennsylvania State College.

is about the effect of the addition of builders to detergency that your attention is directed.

The term builder is used widely in the laundry industry to refer to an alkali or alkalies which are added to soaps to improve their effectiveness as detergents. The more common builders are sodium hydroxide, sodium metasilicate, trisodium phosphate, sodium carbonate, and sodium bicarbonate. These alkalies may be added individually, or in combination, to soap.

Alkaline builders, when used in the washing process, are supposed to supplement soap, but not to replace it. As a supplement to soap, alkaline builders perform a number of functions. Practically all soiled clothes when treated with soft water alone give a slightly acid reaction, hence we have our first function of an alkali or builder—the neutralization of the acid present in soiled clothes.

The builders also act to a certain degree as softeners of hard water. The majority of textile mills and laundries use soft water; but occasionally hard water is used in a laundry, and the use of some of the alkaline builders will tend to counteract this hardness.

Builders prevent the decomposition of soap at high temperatures. For example, in laundry work, better soil removal is obtained at temperatures from 140°-160° F. If the soap concentration is too low, particularly if there is not sufficient alkali present, there is a tendency on the part of the soap to decompose and form free fatty acids. When this happens, the suds break down and we have what is known in laundry parlance as a falling suds. When this takes place, the suspended dirt and soil is precipitated upon the washed fabrics, and grey work results. The use of alkaline builders prevents this tendency of soap to hydrolyze at high temperatures and thus increases the effectiveness of the soap as a detergent.

It is a well known fact that the soil removal efficiency of a soap is improved by the addition of some alkali.

In order to measure this improvement empirically, a standard test fabric has been developed in the Textile Chemistry Laboratory at the Pennsylvania State College, which consists of a square of red striped cotton toweling, used for breaking strength determination, to which is attached a standard soiled and standard white piece. In addition to being used for research work these test pieces are sent to commercial laundries throughout the State of Pennsylvania as a check on the efficiency of their washing procedures. As a method of ascertaining the exact number of times the test fabrics are laundered the black and white checked gingham numbered from 1-50 has been sewn to the right end of the test fabrics. At the end of each laundering one number is cut off. This is repeated for the entire 50 washings. These numbers with the test pieces are returned to our laboratory for examination. Soil removal, whiteness retention, and the fading of colors are measured with a Hunter reflectometer. Breaking strength determinations are made with a Scott tester by the strip method of the American Society for Testing Materials.

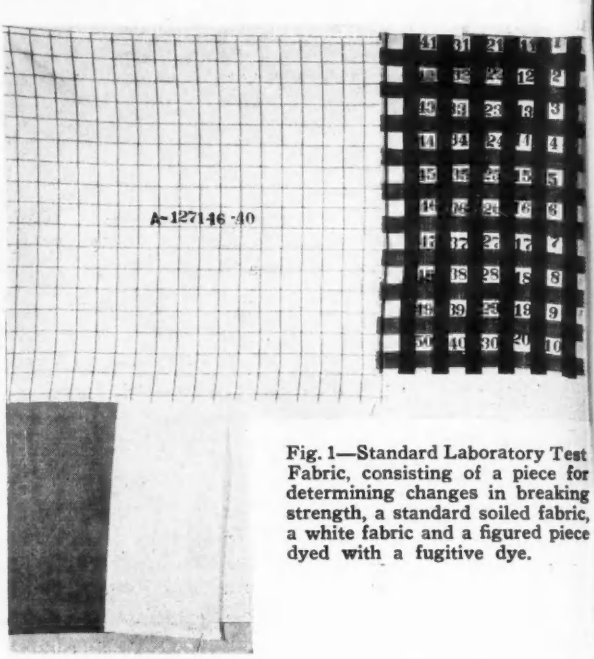


Fig. 1—Standard Laboratory Test Fabric, consisting of a piece for determining changes in breaking strength, a standard soiled fabric, a white fabric and a figured piece dyed with a fugitive dye.

In addition to the test bundle we use a strained strip consisting of a series of eighteen common stains for measuring the effect of various washing procedures on the removal of stains. The staining materials include such substances as hair pomade, vaseline, ink, dye, blood, grass, fruit juices, coffee, tea, cocoa, beer, huckleberries and iodine. These stain strips are used in our experimental work and are also sent to commercial laundries.

In developing a standard soiled fabric a great deal of work had to be done in order to obtain a uniform greyness. It was discovered that one of the most important features was the condition of the cloth prior to soiling. All traces of sizing must be removed from the fabric if uniform soiling is to be obtained. This desizing procedure includes a treatment of the fabric with starch-splitting enzymes followed by a sudsing treatment with soap and alkali, and finally a rinsing with many changes of soft water and finally with distilled water. Carbon black, vegetable fat and mineral oil are used as the soiling mixture. Stoddard solvent (drycleaning solvent) is used as the soiling medium. For some special studies these soiled pieces are coated with starch, casein, or both starch and casein.

The standard soiled cloth is prepared so that each yard of soiled fabric has an initial light reflectancy of 32 $\pm$ 1.5 per cent. Samples from each yard are washed according to a standard procedure to ascertain whether or not the soil is removed with the proper degree of ease. Any soiled fabric not meeting the specifications is discarded.

In our investigation of the effect of alkali on detergency we have run about 500 tests. The washing apparatus

used includes a mechanical washing device in which 20 treatments can be applied simultaneously. All tests have also been repeated in a power laundry wash wheel.

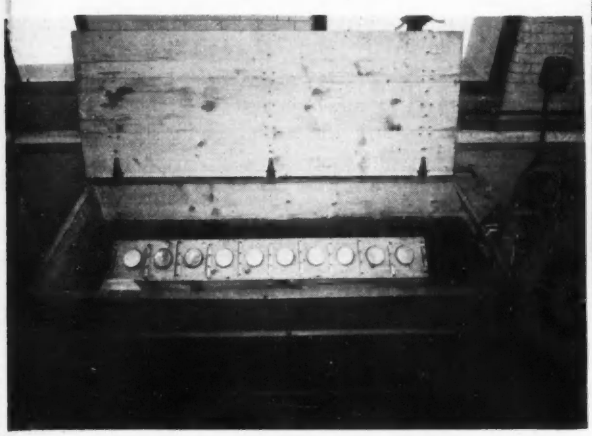


Fig. 2a—Large Sized Mechanical Washing Device for Laboratory Wash Tests.

The alkaline builders studied most intensively were sodium hydroxide, sodium metasilicate, tri-sodium phosphate, and sodium carbonate. The concentrations of the various alkalies were first calculated on the basis of sodium oxide content; nine concentrations ranging from 0.00715 per cent to 0.1713 per cent of sodium oxide were tested with each of the four alkaline builders mentioned. This wide range was selected because it covered all possible quantities of alkalies which might be encountered in any laundry procedure where alkaline builders are used with the soap. The above range of sodium oxide concentrations may be recalculated in terms of each of the alkalies, giving the following values:

TABLE I

Range of Concentrations

	%	%
Sodium Hydroxide	0.0092	to 0.2210
Sodium Metasilicate	0.0245	to 0.5880
Tri-sodium Phosphate	0.0292	to 0.7000
Sodium Carbonate (Soda Ash)	0.0124	to 0.2940

Standard soiled samples were processed and analyzed at the end of 10, 20 and 50 treatments, and breaking strength tests were made after 50 treatments.

The breaking strength losses for all four alkalies studied under the above sets of conditions were negligible, being less than 5 per cent in every case.

The maximum point of soil removal efficiency for each of the four alkalies fell at a concentration between 0.02 per cent and 0.04 per cent of sodium oxide (Na_2O). Below 0.02 per cent, the detergency fell off rapidly; and above 0.04 per cent, it did not improve. These limits expressed in terms of the various alkalies give the following results:

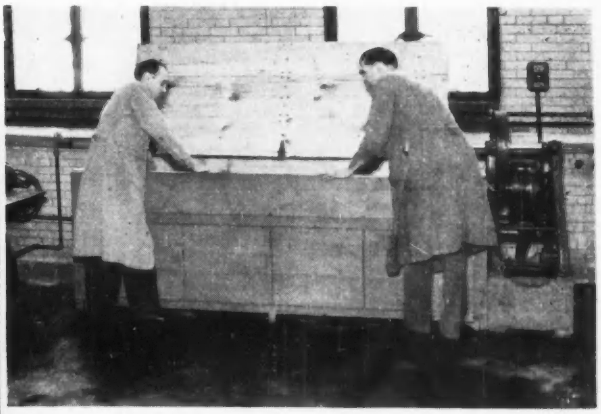


Fig. 2b—Another View of Washing Device. Mr. Oesterling is on the left.

TABLE II

	Percentage on a Solution Basis
Sodium Hydroxide	0.0258 to 0.0516
Sodium Metasilicate	0.0685 to 0.1370
Trisodium Phosphate	0.0816 to 0.1632
Sodium Carbonate (Soda Ash)	0.0343 to 0.0686

After the limits of concentration for the maximum efficiency of alkalies alone were determined, the next important point for investigation is to find a range of soap and builder concentrations which would come within the above mentioned values. This work is under way.

Three alkalies have been examined intensively—namely, sodium metasilicate, sodium carbonate, and trisodium phosphate. Based on their sodium oxide content, each showed a maximum soil removal efficiency at 120° F. (when added to 0.1 per cent soap solution) between the limits of 0.0143 per cent to 0.02822 per cent, which may be expressed in terms of the alkaline builders as follows:

TABLE III

	Lower Limit	*Upper Limit*
Sodium Carbonate	0.024%	0.048%
Sodium Metasilicate	0.049%	0.097%
Trisodium Phosphate	0.058%	0.115%

The above table converted to every-day laundry terms of ratio of soap to builder becomes:

TABLE IV

	Lower Limit		*Upper Limit*	
	Parts of Soap	*Parts of Alkali*	*Parts of Soap*	*Parts of Alkali*
Sodium Carbonate	3	1	2	1
Sodium Metasilicate	2	1	2	1
Trisodium Phosphate	2	1	1	1

Another interesting fact was also observed. After it was found that a built soap solution made up of 0.1 per cent soap and 0.05 per cent sodium metasilicate gave good soil removal results, several 50-wash tests were carried out in which the above-mentioned concentrations were reduced by one-half, that is (0.05 per cent and 0.025 per cent). In another test they were doubled, or changed to

0.2 per cent and 0.1 per cent. Doubling the concentration of the soap and alkali only increased the soil removal by 4.1 per cent, whereas reducing the quantities of soap and alkali, to one-half, decreased the soil removal by 33.6 per cent.

These findings again demonstrate the fact that there is a limit to the amount of soap and builder which should be added to the wheel for the most economical results, but at the same time it must be remembered that, from the standpoint of good work, far more serious trouble will be caused by the use of too light suds (insufficient soap and alkali) than from too heavy suds. Both difficulties can be avoided by using concentrations of soap and builder found by laboratory trial to give good results, but not to be wasteful.

It is interesting to note that, in a stain removal study conducted in 101 commercial laundries in Pennsylvania, using the standard stained strip previously described, the best results were obtained when the ratio of soap to alkali fell within the limits in Table IV. When the ratio of alkali to soap was increased beyond these limits stain removal dropped off. Hence it appears that there is a definite tie-up between soil removal and stain removal.

Now the question might be raised, "Why use different alkalies in laundering procedures?" In laundry work the effect of bleaching of fabric strength must be taken into consideration, since we do not get the same bleaching results with each alkali. The pH of the sodium hypochlorite bleach bath is an important factor with the optimum value being about 10.2 to 10.5. Below this the activity of the bleach is increased causing undue losses in fabric strength, when the bleaching operation is carried out within the usual operating temperatures of 140° F. to 160° F. As we get above a pH of 10.5 the sodium hypochlorite is stabilized to such an extent that good stain removal is not obtained.

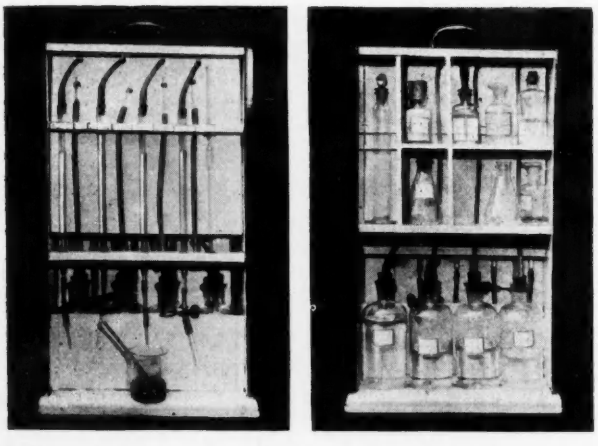


Fig. 3—Standard Portable Test Kit for Determining the Concentration and pH of Laundry Solutions.

The milder types of alkalies are needed in commercial laundry work for washing some fine articles. For instance, a strong alkali would not be used on a wool and cotton mixture, because it would cause shrinkage and discoloration. Although the very strong alkalies may be more effective in the removal of soil from very dirty fabrics, such alkalies must still be used judiciously since fabrics which have undergone considerable deterioration will decompose much more rapidly in strongly alkaline solutions. There is a place for all the common alkalies in the laundry field.

The subject of the effect of the addition of alkaline builders to soap is by no means a closed one. We have merely scratched the surface in our experimental laboratory work and practical tests which have been run in commercial laundries. The laboratory work has been confirmed by practical tests in the laundry field.

Over a period of several years approximately eighty Pennsylvania power laundries have processed over three thousand standard test fabrics as a check on the efficiency and effectiveness of their washing procedures. The results of these tests have been in close agreement with our laboratory findings.

Dr. Hall has given a very excellent discussion on the many factors which must be taken into consideration in detergency studies. We are continuing our work along these lines, tying it in with the practical tests which have already been made in our laboratory at the Pennsylvania State College.

FALL MEETING, SOUTH CENTRAL SECTION

THE Fall meeting of the South Central Section was held at the Hotel Farragut at Knoxville, Tennessee on October 8th, with approximately 50 members attending the banquet, most of these attending the Tennessee vs. Auburn football game in the afternoon.

The principal speaker of the evening was Mr. Chas E. Bachelder, B.T.C., of the Tennessee Eastman Corporation of Kingsport, Tennessee, who discussed the general features of manufacturing and quality control of acetate yarn.

Mr. Bachelder's talk was illustrated by lantern slides, following a picture of the various processes and departments taken at the plant in Kingsport. Mr. Henry R. Childs, chemical engineer of the same company, assisted Mr. Bachelder in these illustrations.

Mr. Adam Fisher of the Chemical Division of the Du Pont Company gave a paper on water repellent finishes, with reference to their product Aridex, which was followed by a sound moving picture on skiing.

Mr. Nestor Grotelueschen, chairman of this section, was in charge of the meeting, which seemed to be greatly enjoyed by everyone present.

Respectfully submitted,

W. S. McNab, *Secretary.*

The Value of Synthetic Detergents*

HAROLD L. JONES**

SYNTHETIC organic products have value in the textile industry as detergents because they are more efficient or less expensive than soap, or because they can be used in processes for which soap is not suited. You are all familiar with the two main faults of soap in textile processing; first, the formation of sticky insoluble soaps in hard water, and second, the lack of stability to acids. In fact, soap gives an alkaline reaction in water and decomposition takes places if the pH of the bath is brought below 9 to 10.

The new synthetic organic detergents are the results of efforts made to overcome the faults of soap. The initial impetus to the research for new detergents was given by Germany during the World War, when their research chemists attempted to find substitutes for natural fats and oils. This search has continued in all industrial countries in a systematic manner to the present day, and there are now numerous so-called synthetic products offered for sale as detergents.

The new synthetic detergents fall into two general classes; first, those which make use of the long straight hydrocarbon chain which is found in natural fats and oils, and second, those which are synthesized from starting materials other than the natural fats and oils. All detergents have two things in common: a water insoluble or hydrophobic part, and a water solubilizing or hydrophilic part. All detergents have high molecular weight compared to water. These factors cause orientation of the detergent molecules on the surfaces and interfaces of water solutions, with the water soluble part of the molecule in the water, and the water insoluble part sticking out of the water. Further, clusters of the detergent molecules cling together in the water as micelles, and give the solution colloidal properties. Solutions of the new synthetic organic products, or surface active agents, exhibit wetting and scouring properties. The factors which cause the detergency of soap solutions are also responsible for the scouring properties of the new synthetic organic products. The new products are sometimes called colloidal electrolytes, or paraffin chain salts.

The lack of stability of soap to hard and acid water is a direct result of the character of the water soluble group. The carboxyl group, which solubilizes the molecule when present as the sodium salt, becomes water insoluble when present as the free acid or as alkaline earth or heavy metal salts. No. 1 in Table I shows the chemical formula

TABLE I

Some Types of Detergents

1. $CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2$-COONa—Sodium Laurate (Soap).
2. $C_{11}H_{23}COONa$ or RCOONa.
3. $RCONHCH_2CH_2SO_3Na$—Oleic taurine.
4. $ROSO_3Na$—"Ocenol" sodium sulfate.

for sodium laurate as an example of soap. This may be written in a condensed form, or as a type formula as shown in No. 2. Efforts to overcome the two main faults of soap were first directed toward blocking the carboxyl group. An example of this type product is oleic taurine, shown as type formula No. 3. "R" in this formula represents the hydrocarbon chain of oleic acid. Then the carboxyl group was completely eliminated, and other water solubilizing groups introduced. The alcohol sulfate products represent an example of this type, shown as No. 4. If the "R" group stands for the hydrocarbon chain of the alcohol corresponding to oleic acid, then the formula represents "Ocenol" sodium sulfate.

A large number of variations in the chemical structure of products similar to the ones shown have been made. The relative value of these products ranges from excellent to mediocre, and even to questionable value. The properties of all of these products can be altered considerably by changing the size, or molecular weight. The alcohol sulfate products are convenient to use as examples of the variations in properties resulting from changes in the hydrocarbon chain. Furthermore, the alcohol sulfate products as a class are among the best of the synthetic detergents for performance and variety of uses. The products to be discussed are for the most part prepared from pure alcohols, and not from the commercial alcohols.

The first property under consideration is solubility. The next table (Table II) shows the solubilities of

TABLE II

Solubilities of Alkyl Sulfates at 25° C.

Alcohol Sulfate	*Sodium Salt*	*Calcium Salt*
Octyl	Over 50%	Over 400 g./l.
Decyl	Over 45	200-300 g./l.
Dodecyl	Over 40	300-400 mg./l.
Tetradecyl	5.0-7.5 g./l.	30-40 mg./l.
Cetyl	Below 0.5 g./l.	Below 5 mg./l.
Octadecyl	Below 0.2 g./l.	Below 2 mg.l/

*Presented before Phila. Section, April 22, 1938.

**Technical Laboratory, E. I. du Pont de Nemours & Co., Inc.

various alcohol sulfates as both sodium and calcium salts at 25° C. (77° F.). The term solubility is used here to indicate the quantity of alcohol sulfate which will remain in solution for a period of 24 hours. The octyl, decyl, and dodecyl sodium sulfates are extremely soluble in water at 25° C. Then there is a definite drop in solubility between the dodecyl and tetradecyl derivatives. Cetyl and octadecyl sodium sulfates have very low solubilities at 25° C. The solubilities of the calcium salts have similar relationships to each other, but the higher molecular weight calcium salts are much less soluble than the sodium salts. The solubility of cetyl sodium sulfate increases tremendously if the temperature is raised to 46° C. (115° F.). Likewise octadecyl sodium sulfate has greatly increased solubility if the temperature is raised to 55° C. (131° F.). With the calcium salts the temperature of greatly increased solubility is 73° C. (163° F.) for the tetradecyl derivative, 82° C. (180° F.) for the cetyl derivative, and 95° C. (203° F.) for the octadecyl derivative. The alcohol sodium sulfates are very much more soluble than the corresponding sodium soaps. For example, the solubility of sodium laurate is about 15 per cent at 25° C., while sodium stearate is practically insoluble at this temperature. Sodium stearate becomes soluble at 69° C., whereas octadecyl sodium sulfate becomes soluble at 55° C.

The calcium salts are considerably more soluble in solutions of the alcohol sodium sulfates than in water. Figure 1 shows the solubility of tetradecyl or myristyl calcium sulfate in solutions of "Gardinol" WA. "Gardinol" WA is the commercial alcohol sodium sulfate made from alcohols obtained from coconut oil fatty acids. You can see the temperature of solution decreases rapidly as the concentration of "Gardinol" WA is increased. Figure 2 shows similar data for cetyl calcium sulfate. Figure 3 shows the solubility of octadecyl or stearyl calcium sulfate in solutions of "Gardinol" WA. These data show that the alcohol sodium sulfate products represent a great advance in overcoming the lack of stability of soap to hard water.

The next property under consideration is stability to hydrolysis. Soap is perfectly stable to alkalies, but is absolutely unstable in the presence of acids. The next table (Table III) shows the stabilities of various synthetic products to hydrolysis. The alkyl sulfates are perfectly stable in the presence of alkalies, but hydrolyze slowly in the presence of strong acids. Alkyl sulfonates are stable in the presence of either strong acids or alkalies. Fatty acid taurines and ethionates are subject to hydrolysis in the presence of either strong acids or strong alkalies.

The rate of hydrolysis of the alkyl sulfates in strong acids varies with the length of the hydrocarbon chain. The next table (Table IV) shows the variations in the

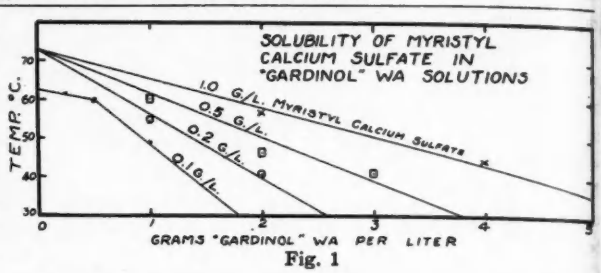


Fig. 1

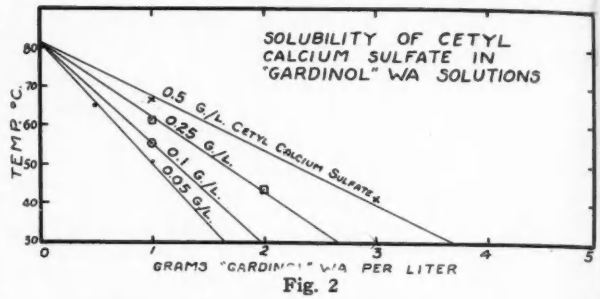


Fig. 2

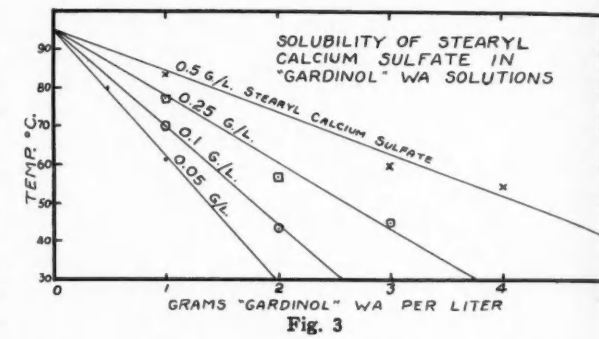


Fig. 3

TABLE III
Stability of Hydrolysis

$ROSO_3Na + HOH$	Strong Alkalies	No hydrolysis
$ROSO_3Na + HOH$	Strong Acids	Slow hydrolysis
$RSO_3Na + HOH$	Acids and Alkalies	No hydrolysis
$RCONHC_2H_4SO_3Na + HOH$	Acids and Alkalies	Hydrolysis
$RCOOC_2H_4SO_3Na + HOH$	Acids and Alkalies	Hydrolysis

TABLE IV
Hydrolysis of Alkyl Sulfates in Boiling 1 Per Cent Sulfuric Acid

Alkyl Sodium Sulfate	*Reaction Velocity Constant*	*Half Life period*
Butyl	1.22×10^{-3}	576 min.
Hexyl	1.26	557
Octyl	1.43	491
Decyl	10.0	70
Dodecyl	33.2	21
Tetradecyl	41.2	17
Cetyl	48	14
Octadecyl	53	13

rate of hydrolysis of some alkyl sodium sulfates in boiling 1 per cent sulfuric acid. The half life period is a convenient way of showing the relative stabilities. If one-half the quantity of alkyl sodium sulfate is decomposed in a given period of time, then one-half of what remains will decompose in the next like period of time, and so on. Notice that the rate of hydrolysis increases with increasing chain length. There is a very marked increase in rate between the octyl and decyl derivatives. The next table (Table V) shows the rate of hydrolysis of "Lorol"

TABLE V

Hydrolysis of 1 Per Cent Lorol Sodium Sulfate in Sulfuric Acid

Acid Concentration	*Temp.*	*Reaction Velocity Constant*	*Half Life Period*
1.0%	25° C.	2.4×10^{-6}	201 Days
3.0	25	4.0×10^{-6}	120 Days
5.0	25	5.0×10^{-6}	97 Days
1.0	50	0.8×10^{-4}	145 Hrs.
3.0	50	1.6×10^{-4}	72 Hrs.
5.0	50	1.7×10^{-4}	68 Hrs.
0.2	100	5.0×10^{-4}	23 Hrs.
1.0	100	3.5×10^{-2}	20 Mins.

sodium sulfate at various concentrations of sulfuric acid and various temperatures. At a given temperature the rate of hydrolysis increases with increase in acid concentration. Furthermore, the rate of hydrolysis increases with increasing temperature.

We have so far discussed the hydrolysis of the alcohol sulfates in the presence of a single acid. The next table (Table VI) shows the effect obtained when salts are

TABLE VI

Hydrolysis of Octyl Sodium Sulfate in Boiling 1 Per Cent Sulfuric Acid with Added Electrolytes

Electrolyte	*Conc.*	*Reaction Velocity Constant*	*Half Life Period* Hours
None		1.43×10^{-3}	81
Sodium sulfate	14.7 g./l.	0.57	205
Sodium Sulfate	44.1	0.11	1063
Sodium chloride	12.1	1.23	95
Sodium acetate	17.0	0.15	780
Monosodium phosphate.	8.28	0.45	260

added to the sulfuric acid. You will note that the addition of salts which have buffering action and increase the pH of the acid bath cause a great decrease in the rate of hydrolysis. Sodium chloride which has little buffering action has little effect on the rate of hydrolysis. The amount of salt added in these illustrations is equal in normality to the normality of the sulfuric acid, except for the high concentration of sodium sulfate. Since the alcohol sulfate products are usually used in the presence of sodium sulfate in acid solutions, it is readily seen that the useful life is very much greater than the duration of the operation.

We have seen how the alcohol sulfate products differ from soap in their relative stabilities to acid and hardness,

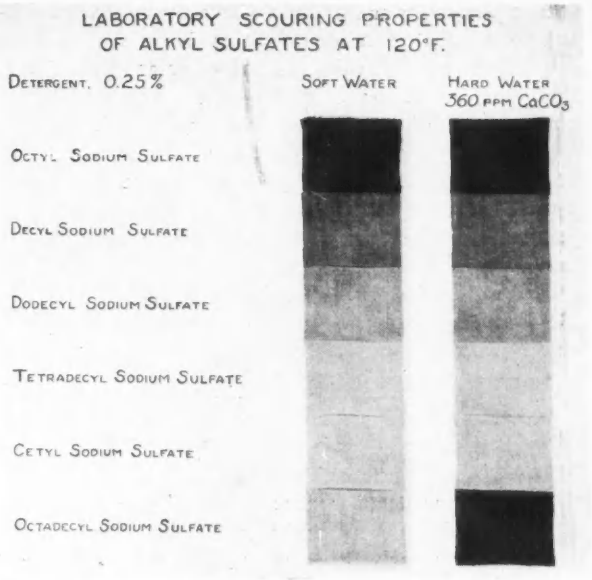


Fig. 4

and the effect of the length of the hydrocarbon chain on these properties. The length of the hydrocarbon chain also has considerable effect on the detergent properties of the alcohol sulfate products. Figure 4 shows the effect of the length of the hydrocarbon chain on the scouring properties. Notice that the scouring efficiency increases with increased chain length to a maximum at cetyl sodium sulfate in both soft and hard water. Then there is a slight decrease in soft water with octadecyl sodium sulfate, and no value in hard water. These variations were obtained in a laboratory scouring test using a wool fabric artificially soiled with mineral oil, lanolin, olive oil and carbon black.

Another difference between the new detergents and soap is the difference in affinities for fibers. Adam has determined by a semi-quantitative method the amounts of various detergents which are adsorbed by cotton and wool. These figures are given in the next table (Table VII). There is a very marked difference in the amount

TABLE VII

Adsorption of Detergents by Cotton and Wool

(Adam, J. Soc. Dyers and Colorists *53*, 121 (1937)

Detergent	*Lbs. Adsorbed per Piece 100 yd. x 40 in.* *Wool Serge*	*Cotton Cloth*
Soap	2.3	0.17
Cetyl sodium sulfate.....	0.3	0.17
Cetane sodium sulfonate	0.8	0.23
Oleic taurine	0.17	
New detergent of amide type.....	0.12	0.12

of synthetic detergent adsorbed by wool compared to the amount of soap adsorbed. On the other hand the amounts of detergent adsorbed by cotton are all about the same. Adsorption of detergents by silk is probably similar to that of wool, and rayon to that of cotton.

Laboratory tests and mill trials have shown that particular alcohol sulfate products are from five to fifteen times as effective as soap in the removal of grease from fibers, when the comparison is made on a fat basis. Other synthetic detergents are also in this range of effectiveness. This efficiency is a necessary condition for synthetic detergents, for otherwise they would not be economical to use. Soap is a low cost industrial commodity, and the synthetic detergents are necessarily more expensive because of the large number of chemical operations involved in their manufacture.

One more property in which the length of the hydrocarbon chain influences the efficiency considerably is the wetting efficiency. The next table (Table VIII) shows

TABLE VIII

Wetting Efficiencies of Alkyl Sulfates at 25° C.

Alkyl Sulfate	*Conc. to give sinking in 25 sec.*
Ocetyl	5.5 g./l.
Decyl	1.44 g./l.
Dodecyl	0.86 g./l.
Tetradecyl	0.45 g./l.
Cetyl	Insufficient solubility

the wetting efficiencies of various alcohol sulfate products at 25° C. (77° F.) measured by the official sinking time method. The wetting efficiency increases with increase in chain length until the molecule becomes too large to be soluble. An increase in temperature is accompanied with an increase in wetting efficiency up to a certain point, and then the wetting efficiency falls off.

Synthetic organic products have found wide application in the textile industry. Since variations in the length of the hydrocarbon chain cause considerable variations in the properties, the choice of a product for a particular purpose must be carefully made. Some applications of the synthetic detergents in the textile industry are: scouring grease wool, pulled wool, tops, yarn, and piece goods, backwashing, fulling, kier boiling, desizing, soaping dyed and printed cottons, degumming, scouring silks and rayons, soaping dyed and printed silks and rayons, and others. In addition to the uses as scouring agents, the new detergents find application in the textile industry as wetting agents, agents to improve rewettability, dyeing assistants, emulsifying agents, conditioning agents, stripping agents, and finishing agents.

A brief review of other industries that are working with the synthetic detergents may be of interest. In the cosmetic industry several types of new detergents are being sold as shampoos, and foaming agents for the bath. The new detergents are also being used as emulsifying agents for all types of creams, including shaving creams, and as cleansing and foaming ingredients of dentifrices. In the mining industry the new detergents can be used as flotation agents. Flotation is the process of separating the valuable minerals from the worthless part of the ore, by collecting the valuable mineral in the froth while the worthless part remains in the bottom. The new detergents are being experimented with as wetting agents to lay dust in mines, and thus to lessen the health and explosion hazards. In the leather industry the new detergents are used as wetting and scouring agents, tanning assistants, dyeing assistants, and agents for special effects. In the metal industries the new detergents serve as assistants in the acid, alkaline, and electrometric cleaning processes. They serve as anti-pitting agents and brighteners in electroplating. Buffing compounds of high efficiency contain the new detergents, and they serve as emulsifying agents for wire drawing emulsions. The new detergents are particularly valuable as wetting and spreading agents in insecticides, and some of the new detergents have considerable insecticidal value in themselves. The new detergents can be used as surface tension lowering agents in the chemical treatment of oil wells for the purpose of increasing the rate of production. These are just a few of the many practical uses for the new detergents. They will serve to show how wide the field of application has become in the comparatively short time in which they have been available.

SPECIAL MEETING, NEW YORK SECTION

A SPECIAL dinner meeting of the New York Section was held jointly with the American Association of Textile Technologists on Tuesday evening, August 16, 1938, at the Chemists' Club, New York City. The purpose of the meeting was to welcome a group of delegates from Europe representing the International Association of Color Chemists who were, at that time, completing a tour of the textile centers in this country. Henry F. Herrmann acted as toastmaster. In his opening remarks Mr. Herrmann said, in part:

"Ladies and gentlemen, this is going to be a rather complicated greeting, because we have assembled here at least three societies of considerable size and importance. For some reason or other, I have been selected to act as toastmaster, and as spokesman for those societies of the United States greeting the representatives of eleven nations who have honored us with their visit. So on behalf of the American Association of Textile Chemists and Colorists and the American Association of Textile Technologists, I have the honor to greet the members of the Melliand European Textile Tour, known to most of us as the representatives of the International Color Chemists, who have come to this country. We felicitate them upon the completion of what we understand has been a very enjoyable and instructive tour."

Louis S. Zisman, chairman of the New York Section of the A.A.T.C.C., was then introduced and he spoke in part as follows:

"As chairman of the New York Section of the American Association of Textile Chemists and Colorists, I deem it a great privilege to welcome this international group of textile chemists and technicians. I hope that your trip, which has brought you to some of our largest plants in the East,

has been interesting and instructive. It is a very happy occasion to be here with you tonight. It is always a pleasure to meet our fellow chemists, especially those who have traveled so far to do us honor. I hope that your brief stay here will be pleasant and that you will enjoy your trip home."

The next speaker was Dr. Joseph F. X. Harold who welcomed the guests on behalf of the American Association of Textile Technologists, of which organization he is president. A portion of his remarks follows:

"I salute you, greet you, and feel distinctly pleased to have the opportunity of conveying to you the sentiment of the American Association of Textile Technologists in welcoming you all from the bottom of our hearts. We are especially pleased for the significance of the grouping of men in our own specialty who come from all parts of the world.

"There is nothing that beats down the barriers of geographical separation so much as the pursuit of truth, and science is, after all, only a measure of that pursuit. It is ennobling and very satisfying to feel that while other countries may be torn with disputes of all sorts, we have the time, the leisure and the kindly feeling to welcome a fellow scientist, no matter where he comes from, where he worships, or what his race or kind. It makes me especially happy, therefore, to greet you."

At this point Mr. Herrmann called on Mr. Melliand to speak on behalf of the International group. Mr. Melliand said, in part:

"Please let me thank you most cordially on behalf of the European Textile Travel Group for the exceedingly kind reception you have given us.

"In recognition of the importance of international relations in the field of textile technical science, I organized this trip and I feel certain that the exchange of experience will be to the advantage of all participants. But what has impressed us most lastingly in this beautiful country is the most wonderful cordiality which we have been accorded. Undoubtedly American hospitality seems to stand at the top of the world. However, we have not come only to admire great technical progress in your country and to learn from you, but we also want to ask you to come to us and to see our work.

"In our group we have representatives of eleven European nations, amongst them the leading textile manufacturers. I have the honor to invite you most cordially, in the name of all the participants in our group, to come to us, and if you should do so, we will most gladly be at your disposal. We beg you to give us a chance to thank you again in the name of us all."

Mr. Melliand then called upon Prof. Eloed, representative of Prof. Dr. Mecheels, president of the International Association of Color Chemists, to speak. Prof. Eloed said, in part:

"The real goal of our party was to meet you and to see what the present situation is in the textile industry in your country. Some of us thought that you had big plants, important industries, that you had made important investigations and so on, but that is not enough. You have done other things. You have found out that the knowledge of modern chemistry and the application of scientific investigation are the real foundation of the importance of your industry.

"I am sure that is also true in other countries. It is true in my country and in the other countries represented here. Not only is it a tie between science and practice, but it can also be a tie between the different nations. In the difficult times we are experiencing today this bridge of science—and of applied science—should be the best basis for cooperation between the different nations. I hope that the applied sciences will bring about real friendship between the different nations of the world."

Mr. Melliand also called upon Count [illegible]ani who addressed the group in Italian.

Following the exchange of greet[illegible] Verner von Bergen, Oscar Geier and Eric P[illegible] addressed the gathering in German.

There was an attendance of about 200.

Respectfully submitted,

P. J. KENNEDY, *Secretary.*

FALL MEETING, PIEDMONT SECTION

THE Fall meeting of the Piedmont Section was held Saturday, October 8th, at the Charlotte Hotel, Charlotte, N. C.

The majority of the members attended the football game that was played in Charlotte between V.M.I. and Clemson College that afternoon, while a few of the remaining played golf. Due to unavoidable circumstances we were unable to have a technical session at this meeting.

The usual informal banquet was held at 8 PM in the ballroom of the Charlotte Hotel. We had as guests the Mayor of Charlotte and the business manager of the Charlotte Chamber of Commerce. We had invited the Governors of North Carolina and South Carolina, both of whom had planned to attend the game, but were unable to get to Charlotte. After dinner the members were first entertained by a musical performance, then by the main speaker of the evening, Mr. William Winter, local commentator of radio fame. His subject, "Keeping America Safe for Democracy," was very interesting and enlightening.

The meeting was then turned into a business session for the election of officers for the coming year, as well as hearing the reports of the outgoing officers on the year's work. The new officers elected were:

A. Henry Gaede, chairman; Laurel Soap Manufacturing Co., Charlotte, N. C.

H. E. Kiefer, vice-chairman; Ware Shoals Manufacturing Co., Ware Shoals, S. C.

J. W. Ivey, secretary; The Mathieson Alkali Works, Inc., Charlotte, N. C.

Henry B. Dixon, treasurer; May Hosiery Mills Burlington, N. C.

Raphael E. Rupp, councilor; Pacific Mills, Lyman, S. C.

A. H. Grimshaw, representative on National Nominating Committee; North Carolina State College, Raleigh, N. C.

Sectional Committee: C. Norris Rabold, Union Bleachery, Greenville, S. C.; Frederick A. Whitney, Granite Finishing Works, Haw River, N. C.; H. Grady Miller, Elliott Knitting Mills, Hickory, N. C.

The fourth member has not been selected at present date, but will be announced later.

Respectfully submitted,

J. W. Ivey, *Secretary.*

MEMBERSHIP APPLICATIONS

Active

Richard M. Johnson—Chemist in Dyehouse, Celanese Corporation of America, Cumberland, Md. Sponsors: W. T. Normand, Jr., H. Platt.

Alfred Knup—Vice-President, Hellwig Silk Dyeing Co., Philadelphia, Pa. Sponsors: A. W. Etchells, H. S. Travis.

Donald M. Martin—President, Aqua Sec. Corp., New York, N. Y. Sponsors: B. Uzunoff, H. H. Mosher.

Paul K. McKenney—President, Swift Mfg. Co., Columbus, Ga. Sponsors: A. Jones, R. W. Philip.

Williard L. Morgan—Director of Research, Arnold Hoffman & Co., Providence, R. I. Sponsors: T. H. Roberts, C. Schlatter.

Earl Lee Niles—Dyer, Harriman Hosiery Mills, Harriman, Tenn. Sponsors: N. Grotelueschen, W. S. McNab.

Charles S. Northen, Jr.—Asst. Vice- President, Avondale Mills, Sylacauga, Ala. Sponsors: S. L. Hayes, H. P. Faust.

Luther Arvin Parker—Boss Dyer, Adams-Millis Corp., High Point, N. C. Sponsors: W. A. Daniel, T. R. Smith.

Frank W. Perry—Resident Chemist, Stein Hall & Co., Providence, R. I. Sponsors: D. E. Truax, F. G. LaPiana.

Arthur Winfield Picken—Dyestuffs Demonstrator, E. I. duPont de Nemours & Co., Inc., Columbus, Ga. Sponsors: E. A. Feimster, Jr., A. Fisher, Jr.

George K. Plotica—Chemist, Deering Milliken Co. Inc. Cowan Mill, Lewiston, Maine. Sponsors: J. M. Washburn, Jr., H. M. Wendle.

William B. Robinson—Salesman and Demonstrator, Henry V. Walker Co., Providence, R. I. Sponsors: G. H. Wood, Jr., D. E. Truax.

Victor L. Sarrailh—Textile Dyer, Paterson, N. J. Sponsors: F. Stubbings, L. S. Zisman.

Melville J. Shaw—Treasurer, American Pad & Textile Co., Greenfield, Ohio. Sponsors: E. S. Atkinson, H. H. Stiegler.

Charles L. Shelton—Textile Chemist, Nye-Wait Co., Auburn, N. Y.

Frederick Wm. Silver—Supervisor of Dyeing & Finishing, Archer Hosiery Mills, Columbus, Ga. Sponsors: A. Jones, R. W. Philip.

William Stafford—Superintendent of Printing, Glen Lyon Print Works, Sayles Finishing Plants, Inc., Phillipsdale, R. I. Sponsors: R. R. Farwell, P. J. Ariente.

James Lawrence Tarwarter—Supt. of Dyeing & Finishing, Harriman Hosiery Mills, Harriman, Tenn. Sponsors: N. Grotelueschen, W. S. McNab.

Walter O. Winkler—Dyer, Forstmann Woolen Co., Passaic, N. J. Sponsors: J. L. Baxter, C. A. Amick.

CALENDAR OF COMING EVENTS

Meeting, Northern New England Section, Andover Country Club, Andover, Mass., November 4, 1938.

* * *

Annual Meeting and Convention, Atlanta-Biltmore Hotel, Atlanta, Ga., December 2 and 3, 1938.

TENTATIVE PROGRAM
Eighteenth Annual Meeting

THE program for the convention, which will be announced in full at a later date, is tentatively as follows:

Friday, December 2nd

10:00 A.M. Opening of registration, and meeting of Council and Research Committee.

12:30 P.M. Luncheon in Georgian Ballroom for all delegates.

2:30 P.M. First technical session.

6:30 P.M. Informal supper for all delegates and their ladies, with Southern entertainment and dancing.

Saturday, December 3rd

9:30 A.M. Second technical session and business meeting.

2:00 P.M. Sight-seeing trips to Stone Mountain, Cyclorama, and other points of interest, and golf for the golfers.

6:15 P.M. Reception at Atlanta Athletic Club.

7:00 P.M. Annual Banquet at Atlanta Athletic Club.

An interesting program of entertainment has been arranged which will be of a decidedly Southern flavor. Honorable E. D. Rivers, Governor of Georgia, and Hugh M. Comer, Vice-President of Avondale Mills, Sylacauga, Ala., will address the Convention at the Friday luncheon and a prominent national figure will deliver the feature address at the Saturday banquet. A feature, of interest to all, will be the exhibit of textile products manufactured by Southern mills which will be on display at the Biltmore Hotel during the convention. Delegates and visitors are urged to bring their ladies, for the ladies' committee has arranged an interesting program in their behalf.

Bleaching

Cotton Knit Goods

The Bleach Process as the Key to Quality

L. P. LONDON*

A GOOD white is relatively easy to obtain, but to keep the natural handle and elasticity of the fabric at the same time is more difficult. Consistent control of these qualities at the lowest processing cost is the aim of practically all bleachers of cotton knit goods. However, the degree of their success is measured by the bleaching method that is used, for it is the type of process that determines the qualities of the finished fabric. Kier bleaching with peroxide will most nearly meet all the requirements of millman and consumer.

A full kier load can be bleached just as easily as a part load. The chemical cost per pound of knit goods is about the same whether it is a 6,000 pound or 1,000 pound lot. If the operation is carried out at night with the use of automatic temperature controls, no added supervision or labor is required.

The kier process in contrast with other methods bleaches the natural fats and waxes of the cotton without the need of extreme temperatures and strong alkalies to extract them. This gives the highest possible weight per yard, which is a worth while consideration, when knit goods are sold on a weight basis.

A general discussion of bleaching methods will bring out more clearly the advantages of kier bleaching with peroxide. It will also show advantages to the consumer by way of high quality.

CAUSTIC PRESSURE BOILING

At one time practically all cotton knit goods were bleached by pressure kier boiling followed by running out through chemic and antichlor. However, the caustic boil with subsequent handling through chemic and antichloring, always harshened the goods. This, together with the frequent formation of kier stains, proved the need for improved fabric quality and simplified plant procedure.

OPEN TUB BLEACHING

The open-tub or slack washer method has come into fairly wide use. Here the cloth passes between rolls and over a reel continuously through the whole period of operation, which will vary from 4 to 6 hours depending on the concentration of bleaching agents.

Open tubs range in capacity from small sample machines to 1,200 pounds maximum. The cloth is loaded into the machine, generally two rolls sewed or tied together in a continuous strand, each strand running through a pocket formed by the pins of the pin rail.

The following is a representative cycle of operations:

1. Treat in a solution containing sodium peroxide. Raise temperature to boiling and run the goods through the solution for one hour.
2. Rinse.
3. Chemic, 2 to 3 grams per liter available chlorine for one hour at 100° F.
4. Rinse.
5. Antichlor.
6. Rinse.
7. Rinse.
8. Blue and soften.

Variations of this formula can be found in practice. For example, caustic soda is sometimes used in place of sodium peroxide. Since the caustic has no bleaching action, an inferior "bottom" is produced and a larger quantity of chlorine must be used in Operation 3. Some such formulas call for as much as 5 grams per liter. In other cases less chlorine is used but the temperature is raised to step up the bleach activity. Another variation is to chemic first, then rinse and treat with sodium peroxide.

In studying the above, a plant manager can well be guided by the following:—From a production standpoint the open tub is limiting, in that light and heavy material cannot be processed in the same machine. Heavy cloth separates the rolls to an extent that they cannot bite and pull through the lighter fabrics. This means that separate machines must be maintained for the different fabrics or the bleaching must be done at different times.

Also, from a production standpoint, another problem results. The whiteness so produced is often not a permanent one. If such cloth is stored for a time and then cut up into garments, it may be found to have yellowed to a shade different from current bleach production. Thus, two lots cannot always be packed together in the same boxes or used on the same garments for sleeves, bodies, etc.

In considering the open tub itself, we see that during the period of bleaching—4 to 6 hours—the cloth is subjected to a harsh mechanical action. The fabrics are continually pounded by the rolls, and the stretching caused by the pulling of the reel cannot help but result in chafing. To cover this physical damage to the cloth, softening agents must be deposited on the fabrics. The consumer then finds that after the first laundering, the nice handle and feel is not retained.

Another sad discovery the consumer often makes is the shrinkage of a garment in laundering. This can be

*Field representative, R. & H. Chemicals Dept., E. I. du Pont de Nemours & Co., Inc.

due in a large measure to the stretching alluded to in the previous paragraph. After all, when cloth is pulled over reels for hours, very definite stretching takes place.

As a matter of dollars and cents, the weight lost by a fabric in such a process should be considered. The difference between the grey and finished weight will run from 5 per cent to 7 per cent as compared with a 2½ per cent to 4 per cent weight loss in kier bleaching with peroxide.

KIER BLEACHING WITH PEROXIDE

The Bleach Operation

This is either a one or two-step operation. When two steps are used, the cloth is first scoured in the kier with a solution of silicate or other mild alkalies. After a wash down in the kier, the bleach liquor is run in and circulated.

The scour before bleaching permits a lower chemical cost. The peroxide concentration can be reduced because the scour has removed some of the impurities. However, about three additional hours are required for the scour, and in choosing a process the added time must be weighed against the saving in peroxide. The one-step kier bleach is generally preferred because of its simplicity.

The following conditions for kier bleaching are typical:

(a) Bleaching agent—hydrogen peroxide, sodium peroxide, or a combination of the two.

(b) Alkalizing agent—Sodium Silicate.

(c) Bleaching temperature—180° F.

(d) Time—5 to 7 hours.

The cloth can be partially rinsed in the kier and unloaded through washers for complete rinsing, and for bluing if this is required. The use of softener is unnecessary because the natural softness meets every requirement for good "feel."

Loading the Kier

Rolls of knit goods are tied or sewed together, then wet out through either a slack or tight rope washer containing a standard wetting agent. Wetting out is continuous, with the cloth running either immediately into the kier or into trucks for kier loading in batches.

Kier Coating

To protect the cloth from possible rust and corrosion stains, the kier is coated with cement containing a small amount of waterproofing agent. After the coating has dried, the kier is boiled out several times with silicate, to give the coating a further protective film.

Heating

Indirect heaters are preferred because they provide good thermostatic control.

Well Stones

The kier well should be filled with ordinary pond stones free from mineral discolorations, to give the liquor easy passage from the cloth to the drain and to allow sufficient head for the pump. This saves approximately 200 gallons of liquor per 4,000 pound kier. Thus, a quarter or half kier can be bleached at almost the same chemical cost per pound of cloth as a full kier load.

Mixing Tank

This is generally made of cypress wood and for a 4,000 pound kier a capacity of 1,000 gallons will easily suffice. The silicate and peroxide are added here and properly mixed.

Steam Consumption

For processing 4,000 pounds of knitwear about 1,500 gallons of water are generally required, including that carried into the kier by the cloth from the wetting out treatment. For bleaching this same 4,000 pounds in an open tub, 4,000 gallons of water are required. Heating 1,500 gallons to 180° F. and maintaining this temperature in a completely closed system permits a worth while steam saving over an open tub treatment where 4,000 gallons must be heated to a boil and maintained at 212° F. with the bleach liquor and cloth completely exposed to the air.

In one plant the figures showed that 3½ tons of coal were saved for each 5,000 pounds of cloth bleached in the kier.

CONCLUSIONS

Kier bleaching of cotton knit goods with peroxide has these advantages:

1. It permits flexibility in mill production.
2. Weight loss in the cloth is low.
3. The chemical treatment in the kier is mild, making for high tensile strengths in the finished goods.
4. The operation does not require abnormal stretching of the cloth and a natural feel is retained.
5. A minimum of shrinkage in use will be assured.
6. It assures permanent whiteness.

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Permanent Finishes

(Continued from page 606)

many types of durable finishes which can be produced. Whilst the alkali-soluble ethers may be applied to linen, jute, cotton and rayon goods, care should be taken in their application to rayon fabrics in view of the alkalinity of their solutions. They are useful also in finishing muslins and voiles, so as to produce organdie-like effects, whilst a durable "linenized" finish is obtainable on cotton fabrics by their use. The advantages of finishes based on alkali-soluble cellulose ethers are—(1) Durable stiffness in place of the temporary stiffening given by starch; (2) resistance to repeated launderings even where heavy fillings have been employed; (3) reduction of the tendency of fabrics to shrink on washing; (4) improvement in tensile strength; and (5) improvement in resistance to abrasion.

These outstanding features apply equally to plain and filled finishes, and the usual fillers can be applied along with the cellulose ethers with satisfactory results, excellent durability being obtained even when the ratio of filler to cellulose ether is as high as 3 to 1. These products, therefore, offer a number of effects ranging from wash-resisting "starched" styles and filled effects, to imitation linens and organdies. All are most durable and the finished goods may be kier-boiled or mercerized without suffering appreciable loss of finish.

The water-soluble cellulose ethers are also of considerable interest, since they permit the production of finishes possessing durability and washing fastness intermediate between starch finishes and alkali-soluble cellulose ether finishes. The water-soluble cellulose ethers are characterized by their peculiar dissolution properties, for, whilst readily soluble in cold water, they are insoluble in hot liquors. Thus, by their application from a cold solution either alone or with added fillers, finishes are produced which show a measure of resistance to removal by hot liquors. The water-soluble cellulose ethers give mucilages, similar in character to those given by natural gums and possessing sizing or stiffening properties superior to starch. They have excellent binding properties for fillers, and solutions of them do not ferment or develop mould. Since they are uniform, the variable results given by the natural gums and starches are avoided. Taking all these properties into account, it will be realized that the production of semi-durable finishes by the use of water-soluble cellulose ethers offers considerable scope to finishers seeking new effects.

It is known that products, like dimethylol-urea, is capable of increasing substantially the resistance to washing shown by starch finishes. Although by the use of such products it is not possible to obtain complete fixation, the production of starch finishes possessing some durability and resistance to washing is practicable.

The last finish to be mentioned in this class is due to an interesting development in wool finishing. It has been shown by the Wool Industries Research Association that wool can be treated in a diluted rubber latex bath to give "rubberized" wool. Since this work is still in its early stages, it is not possible to predict its future utility. It is interesting to note, however, that the rubber is not present as a continuous film, but rather as a fiber coating, so that air permeability is retained and the characteristic properties of the wool fiber are preserved. The increases in strength and resistance of wool to milling and abrasion resulting from the treatment, coupled with the novelty of the product, merit attention.

As regards finishes produced by chemical modification of the fabric or fiber, perhaps the best known is that produced on wool by chlorination. Chlorination by various methods and by the use of a variety of chlorine-containing compounds has received much attention in the last few decades; also treatment of wool with bromine has been suggested. Recently two novel methods have been introduced, viz. the use of gaseous chlorine in one case and sulfuryl chloride in the other. The former method is carried out by the Wool Industries Research Association under reduced pressure. Whilst the use of gaseous chlorine is not a new idea, the suggestion of low pressure treatment is novel. The defects often arising from the use of aqueous chlorinating media are well-known; amongst them are the difficulty of obtaining uniform chlorination throughout the bulk, and the harshening of the fiber which is always most pronounced where over-chlorination occurs. The Wool Industries Research Association claim to be able to avoid these defects and to secure greatly increased uniformity of treatment.

The other process is known as the Dri-sol process. In this system, the wool is immersed in a solution of a suitable organic solvent containing sulfuryl chloride. In practice, white spirit is found to be suitable and a concentration of 1-2 gal. sulfuryl chloride per 100 gal. solvent is recommended. The wool is steeped in this cold solution for 1 hr., hydro-extracted, washed and neutralized. The results show less chemical damage than is caused by aqueous chlorination methods and, although not without effect on the natural handle of wool, the process is claimed to be superior also in this respect.

It is early to attempt to compare the existing processes with these newer methods, or to compare them with each other. Cost, convenience of working and commercial value of final effect will require careful consideration, and ultimate adoption of one or other of these processes will depend upon a due assessment of all these factors. It is interesting and encouraging to note, however, that even the older textile processes are receiving their measure of attention in the search for newer and more satisfactory durable finishes.

The first durable finish dependent upon chemical modification of cellulose to be developed was probably mercerization. This process is an excellent example of a durable finish depending upon chemical alteration of the fiber during processing. Another example is the production of organdie finishes by the Heberlein process. Treatment of cotton with strong sulfuric acid or zinc chloride solution converts fine open texture cotton fabrics into parchmentized, transparent materials known as organdies. The effect is durable and pleasing and has been practiced with success for several years. A recent development in this field is the suggested use of ethylene oxide as a finishing agent for the production of a variety of durable finishes, including organdie-like effects.

A durable finish which might well be grouped in this class, although not perhaps strictly dependent upon chemical modification of the fiber, is the permanent setting or curling process applied to wool and hair. In order to produce permanently curled yarn it has been the custom to submit the "noddles" of tightly twisted yarn to a prolonged boiling process, usually of several hours duration. According to Speakman, the process might be shortened and improved by using in place of boiling water, a solution of an acid sulfite at a temperature of 50-60° C., the liquor

being maintained at pH 6. Improved setting, with preservation of color, handle and strength are said to be obtained and, as the time of treatment is considerably less than that required in the older process, this development might lead to the application of an already known durable effect to yarns not suited to the old curling process.

The most recent introduction of all the durable finishing agents falls within this third group of finishes. Whilst the product is of such recent introduction that accurate determination of the mechanism of its effect has not yet been possible, it is possible that this novel finishing agent produces some chemical modification of fabrics to which it is applied.

It produces durable water-repellent and softened finishes on animal and vegetable fibers.

Although wool, to some extent, is naturally water-repellent, it is not sufficiently so for many commercial purposes, and none of the vegetable fibers used in the textile industry possess any appreciable inherent water-repellency. In consequence, the production of water-repellent finishes has always been a subject of importance to the textile trades, and much ingenuity has been expended in the past on their production. Considerable success has attended the efforts of those who have sought to produce fabrics completely resistant to water, but always at the cost of air-permeability. Tarpaulins, oilskins and rubber-spread fabrics are satisfactorily produced by a variety of processes, but none of them is applicable to more delicate fabrics, e. g. worsted suitings, rayon and silk dress goods, cotton-rayon union upholstery fabrics, etc.

Where drapability and handle, air-permeability and appearance, have to be preserved, entirely different methods are needed for rendering fabrics water-repellent. It has been the practice hitherto to use what is known as the two-bath method, or a single-bath waterproofing agent. These two methods have been gradually developed from older and more complicated methods, most of which depend upon the use of either soap and aluminium salts, or upon paraffin wax alone or in conjunction with aluminium salts. The two-bath method generally consists of the application of soap or paraffin wax in one bath and an aluminium compound in a separate treatment, the ultimate effect being substantially the same as that which results from the use of one of the newer single-bath waterproofing agents, in which wax and aluminium salts have been carefully incorporated in the required proportions by the manufacturer of the proofing compound. Both the single- and two-bath methods have similar disadvantages. If excessive amounts of aluminium salts are used, a decidedly harsh handle is produced on many types of fabrics, and, in addition, the shade of certain dyeings may be affected. If excessive paraffin wax is used, a greasy, unpleasant handle results, there is a tendency for the fabric to collect dirt and, on delicate fabrics, the appearance, handle and drapability are spoiled. Even if these ill effects are minimized by the use of a carefully prepared proprietary single-bath waterproofing agent, in which the ratio of wax to aluminium salts has been proportioned correctly, there still remains the additional defect common to all these methods, viz. lack of fastness to washing and dry-cleaning processes.

Whilst it is not claimed that this new product produces water-repellent finishes with actual water-repellency superior to that given by the older proofing agents, it is considered that, judged on durability, the new product offers valuable advantages, and, moreover, as far as handle, drapability and softness are concerned, it gives immeasurably superior results.

TRADE NOTES • NEW PRODUCTS

Ciba Introduces Neocotone Colors

CIBA Company, Inc., Greenwich and Morton Sts., New York City, has introduced a new series of patented dyestuffs which are designated as *Neocotone Colors,* and which are said to be particularly suitable for printing on cellulosic fibers. It is stated that the entire line is water soluble and may be fixed by a short steaming (not acid), followed by a treatment in a dilute caustic soda bath. It is further stated that these colors are definitely stable either in powder form or in acid and neutral printing pastes. It is claimed that they are suitable for both direct printing and padding. Padded shades are dischargeable to a pure white and may be used as grounds for color discharges. Outstanding advantages claimed for these colors are:

Fastness to light; fastness to washing; do not require acid ageing; in printing, appear in the shade of the finished color, thus giving complete visibility without any sightener; can be used with aniline black; do not require the use of solubilized vat colors, but can be run with and fitted to regular vat printing pastes.

A circular has been released on the first member of the series and is entitled:

Neocotone Scarlet G—which is suitable for application to all forms of cotton and viscose rayon. The resultant bright prints are said to be of good fastness to light, washing, chlorine, perspiration and crocking. The circular is illustrated with a swatch cut from a practical run made in this country, under normal print-works conditions, and with regular equipment. There are two accompanying colors of vat pastes and the black is aniline black. Very simple printing and developing recipes are also given in the circular. Copies of this circular are available upon request.

It is stated that the final result of a Neocotone print is comparable to the best of the naphthols, without the necessity of a special naphthol prepare. It is further claimed that they surpass the working properties of all other prepared azoic colors in being visible at all times and not requiring a passage in an acid ager. It is also said that they will make possible many savings in total costs because they do not require the use of special solubilized or esterified vat dyes to work with them, but may be printed beside ordinary vat dyes, as well as aniline black.

Announcement will be made shortly of other members of this series.

• BLICKMAN CIRCULAR

S. Blickman, Inc., Weehawken, N. J., has recently distributed copies of the fifth in a series of circulars entitled:

Stainless Steel Equipment for the Dyeing and Textile Industry—which features the following equipment: *Stainless steel portable tank*—which is a dye-mixing tank mounted on a portable stand and equipped with an adjustable agitator. It is stated that with this equipment it is possible to easily and speedily transfer dyes to tanks, vats or dye boxes and permits mixing the dyes at a central point. The tanks can be furnished in any size from 50 to 500 gallons capacity. *Stainless steel dye boxes*—these boxes are of all stainless steel construction and are self supporting to which can be attached reels, idler rolls, drives and other present equipment. Copies of this circular, which also describes other stainless steel equipment, are available upon request.

• A.A.T.T. MEETING

The next regular meeting of the American Association of Textile Technologists will be held at the Architectural League Club Rooms, 115 East 40th Street, New York City, on Wednesday, November 2nd. Dinner will be served at 6:30 and a lecture will follow at 8 o'clock. The speaker of the evening will be Harold W. Brightman, vice-president and general merchandise manager of L. Bamberger & Co., who will speak on the subject: "The Consumer Movement — New Opportunities for the Technologist."

• GENERAL RELEASES

General Dyestuff Corp., 435 Hudson Street, New York City, announces releases of circulars describing the following products:

Brilliant Discharge Blue B—an acid color which is of principal interest for discharge prints on wool and silk. This product does not discharge very well but it offers the very desirable advantage that the discharges will not develop a bluish tint on exposure to light. The product produces a very bright blue shade said to possess fastness properties which are satisfactory for average silk or wool print work. Circular I.G. 1539.

Indanthren Brilliant Scarlet RK Powder Fine For Dyeing—a new homogeneous Vat dyestuff, which is said to represent the fastest to light scarlet available. For this reason it will be of particular interest for the dyeing of cotton piece goods whenever the brightest possible scarlet shades are required without any sacrifice in degree of fastness to light. It is highly recommended by the manufacturers for use by the pigment padding process on account of its extremely fine state of division. It is furthermore recommended by them for the dyeing of cotton yarn and for the production of pale shades on rayon. Circular I.G. 1512.

duPont Announces "Nylon"

DEVELOPMENT of a wholly new synthetic material of hundreds of potential uses, one of which will be of revolutionary importance in fine hosiery, was announced on October 27th by E. I. du Pont de Nemours & Company.

Christened "nylon," the new material was considered by du Pont chemists to be one of the most significant developments in the history of industrial research in the United States.

Though wholly fabricated from such common raw materials as coal, water and air, it is stated that nylon can be fashioned into filaments as strong as steel, as fine as the spider's web, yet more elastic than any of the common natural fibers and possessing a beautiful luster.

In its physical and chemical properties, the textile fiber produced from nylon differs radically from all other synthetic fibers and constitutes the first man-made organic textile fiber prepared from raw materials of the mineral kingdom.

In its formal statement, the company said that nylon's possible uses also include bristles, racquet strings, transparent wrapping film, plastics, and coated fabrics.

The statement follows:

"The new synthetic material is the outgrowth of research that has covered the better part of a decade. Its objective was the synthesis from readily available native raw materials of a wholly new group of chemical compounds capable of meeting definite deficiencies in many existing industrial materials that in the main are now imported.

"This group of compounds is called *nylon*, a coined name. Nylon is the generic name for all materials defined scientifically as synthetic fiber-forming polymeric amides having a protein-like chemical structure; derivable from coal, air and water, or other substances, and characterized by extreme toughness and strength and the peculiar ability to be formed into fibers and into various shapes, such as bristles and sheets.

"A sum of more than $8,000,000 has been appropriated to construct near Seaford, Delaware the first unit of a plant to produce nylon textile yarn. Construction is expected to require 12 months and is scheduled to start early in December. When completed this initial plant unit will give employment to approximately 1,000 people.

"For several months a pilot plant has been operating near Wilmington to produce small commercial quantities of nylon yarn and "Exton" toothbrush bristles made from nylon. As the output of the pilot plant is limited, nylon will not be widely available until the Seaford plant is operating.

"Like natural silk, nylon is a polyamide having a protein-like structure. Filaments of extreme fineness can be spun—much finer than the filaments of silk and rayon. The dyeing of nylon presents no particular difficulty. In general it will take dyes used for silk, wool,

• CIBA REVIEW

Ciba Review, Number 14, has recently been distributed. Featured in this issue is "Cloth Making in Flanders." Articles which carry out this theme are described by the following titles: Flanders; The Influence of Cloth Making on Flemish History; The Social Organization of Cloth Making; The Distribution of the Flemish Textile Industry; Technical Peculiarities of Flemish Cloth Making and Dyeing; Flemish Cloth in Art and Fashion; Historical Gleanings; Scientific Notes. Copies of this publication are available upon application to Ciba Company, Inc., Greenwich and Morton Sts., New York City.

• NATIONAL RELEASES

National Aniline & Chemical Co., Inc., 40 Rector St., New York City, has issued bulletins describing the following products:

National Sulfur Red Brown R C F—a true brown producing warm, reddish tones intermediate in shade between the yellow browns and the bordeaux. It is claimed that because of its good fastness to coarse dyeing, it is eminently suited for coloring warps for various union fabrics later to be cross-dyed. It is low in copper content and is said to be well suited for coloring fabrics that are to be rubberized. Bulletin No. 224.

National Erie Black N U G—a direct black of particular interest to the dyer of cotton-wool union goods. On fabrics of this type it yields full black shades said to cover the wool to a greater extent than the ordinary direct blacks. For this reason it is said that this product is most economical to use and always should be selected whenever the lowest coloring cost is desired. It may be after treated with formaldehyde and acetic acid with the consequent increase in fastness characteristic of the Direct Blacks. Bulletin No. 225.

acetate, and certain of the direct dyes used for cotton or rayon.

"Of particular promise among the prospective uses for nylon is high twist yarn for fine hosiery. Hosiery made of nylon possesses extreme sheerness, high elasticity, high strength, and improved resistance to runs.

"Sewing thread and knit goods also afford attractive outlets. Among other potential uses which number hundreds, are brush bristles, racquet strings, fishing lines and leaders, narrow fabrics, woven dress goods, velvets, knitted and woven underwear, transparent wrapping film, plastic compositions, textile finishing agents, and coated fabrics.

"The nylon business will be conducted by the Nylon Division, Rayon Department of the du Pont Company. Nylon textile yarn differs from rayon in that it does not contain cellulose and is not derived from cellulose. In its physical and chemical properties nylon differs radically from all other synthetic fibers."

• CALCO WINS ADVERTISING AWARD

At the National Industrial Advertisers Association Convention held in Cleveland on September 21st-23rd, the 1938 advertising campaign of the Calco Chemical Company, Inc., was awarded a first prize.

• ARNOLD, HOFFMAN EXPANDS

Arnold, Hoffman & Co., Inc., manufacturers and distributors of chemicals for the textile industry, with main office in Providence, R. I., and plant in Dighton, Mass., have just announced the appointment of two new district sales managers—Robert E. Buck for the Greenville, S. C., territory and Harold T. Buck for the Columbus, Ga., territory. Robert E. Buck will have his headquarters at P. O. Box 904, Greenville, S. C. Telephone, 2922. Harold T. Buck's address will be P. O. Box 843, Columbus, Ga. Telephone, 1099.

Arnold Hoffman already have branch offices in New York, Boston, Philadelphia and Charlotte. It is proposed to install suitable warehouse facilities in the Greenville and Columbus territories for better accommodation of the trade.

Robert E. Buck and Harold T. Buck are sons of the late Robert Buck, who was long connected with the Charlotte office of Arnold Hoffman & Co., and both are well qualified by education and training to serve in their present capacities. Robert attended N. C. State College, University of Virginia and University of N. C., specializing in chemistry and has been employed by Arnold Hoffman & Co. since his graduation. Harold received his B.S. degree from the University of Virginia and University of N. C., specializing in chemistry and has been employed by Arnold Hoffman & Co. since his graduation. Harold received his B.S. degree from the University of N. C. in 1928. Since that time he has had practical training in a textile mill and with his present employer.

• ARMOR GRIDS

Managers of textile plants confronted with the problem of providing industrial floors which must permanently withstand severe shocks, heavy rolling or sliding traffic, and which must resist water and chemical corrosion, will be interested in a bulletin on Armor Grids, published by Snead & Co., 190 Pine St., Jersey City, N. J.

Snead Armor Grids are cast of special grey iron containing moisture and acid corrosion resisting properties in sections measuring 2 x 1 ft. They are used in a wide variety of textile plants for armoring driveways, traffic aisles, ramps, platforms, and other areas which would otherwise require frequent repair and replacement. It is claimed that, in over 25 years, not a single installation of these armor grids has ever had to be repaired or replaced, and that the surface actually improves with use.

The bulletin illustrates how easily the grids are imbedded in concrete or mastic, with which they bond perfectly, without anchoring or fastening devices. The grids are used for new floors and for resurfacing. Their pleasing symmetrical pattern covers 41 per cent of the total floor area with armor and is said to provide a non-slippery, smooth-running surface in all directions. Loads are carried quietly and shocks absorbed. No surface treatments are ever required. The manufacturers will be glad to send a copy of this bulletin to readers of American Dyestuff Reporter.

• NEW CONDUIT FINISH

A new development in protecting steel conduit from corrosion has recently been announced by Walker Brothers of Conshohocken, Pa. By a new process known as "Walkerizing," a uniform coating of zinc is fused into the outside and inside walls of the steel tube. Over this is applied a second coating containing a new, inert substance, which offers strong resistance to acids, alkalis, and salt water.

According to the manufacturer, this new conduit may be used to advantage, not only in industries and locations where chemical conditions create serious corrosion problems, but to assure longer service in all types of installations.

• NEW LOW PRICE FOR CAPROIC ACID

The commercial availability of normal caproic acid at a new low price has just been announced by Carbide & Carbon Chemicals Corporation, 30 East 42nd St., New York, N. Y. Now selling at 35 cents a pound in drum quantities, caproic acid becomes a valuable source of the hexyl group for many industrial syntheses. It is expected to create considerable interest as a chemical intermediate in the manufacture of certain pharmaceuticals, resins, rubber chemicals, and essential oils.

Caproic acid is the normal, straight-chain, six-carbon atom compound of the fatty acid series. It is a colorless liquid of characteristic odor. It boils at 202° C., freezes at 4.7° C., and has a specific gravity of 0.9280 at 20/20° C. It is only slightly soluble in water, but is soluble in alcohol and many other organic compounds. The commercial material contains well over 98 per cent caproic acid by weight.

New esters, anhydrates, salts, ketones, amides and other derivatives useful to industry can be prepared from caproic acid. Its esters are important in the manufacture of flavors, perfumes, and essential oils. The ethyl, amyl, and allyl esters of caproic acid, in particular, are used as synthetic flavors. Caproic acid also offers possibilities for the production of cellulose esters which have greater solubility in organic solvents than those of lower-boiling acids.

Other derivatives of caproic acid, such as the anhydride, salts, or amides, have higher boiling points, greater oil solubility, and lower water solubility than those obtained from acetic, propionic or butyric acids. Furthermore, the normal hexyl group can be introduced into certain pharmaceuticals, resins, rubber chemicals, and related products by means of caproic acid. For example, it condenses with phenols to form capropyl derivatives which on reduction yield hexylphenols.

• OCTOBER TEXTILE RESEARCH

The research on the warp sizing of filament viscose rayon that has been in progress under the auspices of U. S. Institute for Textile Research since January, 1936, has resulted in effective control of the process, and in a substantial reduction in costs, according to the October issue of *Textile Research*. Now that this phase of the study has been completed, the co-operators have voted in favor of extending the research to cotton and spun rayon warps and their sizing materials, and to have the laboratory and experimental mill research conducted in the South and administered by a committee of southern men.

A conference on the subject open to all who may be interested is to be held by the Institute in conjunction with its annual meeting at the Hotel Commodore, New York, N. Y., Thursday, Nov. 10, at 2 P.M. If a representative attendance at the conference favors the research the Institute will undertake its organization and co-operative financing.

Two new and important techniques for the measuring of fiber and yarn strength are described and illustrated in the October *Textile Research*. One is "The Flat Bundle Fiber Tests," by H. R. Bellinson, research assistant, Massachusetts Institute of Technology. The chief advantage is the speed with which results can be obtained, and the inexpensive equipment required. The other article, by M. E. Campbell and G. W. Field of the Bureau of Agricultural Economics, is entitled "A Method of Analyzing Charts of the Moscrop Single-Strand Yarn Tester." Heretofore, it has been impossible to make accurate detailed analyses of these data. The new method is accurate and relatively rapid and practical.

• RESEARCH INSTITUTE'S MEETING AND DINNER

The annual meeting and dinner of U. S. Institute for Textile Research is tentatively scheduled for Thursday, Nov. 10, at the Hotel Commodore, New York City; tentatively, pending the completion of arrangements for speakers and entertainment features of the dinner program. A research conference on the warp sizing of cottons and spun rayons will be held in conjunction with this meeting and will be open to all interested in the subject. Co-operators in the study of viscose rayon warp sizing, which is now approaching completion and which has produced valuable results of practical mill application, favor transfer of the research to cottons and spun rayons. They have also voted to have the work conducted in a southern laboratory and in southern mills is possible. The conference is to be held under the auspices of the Institute's research council to determine whether there will be sufficient interest and support to warrant undertaking the organization and financing of the project.

• CHEMICAL INDUSTRY MEDAL AWARD

The Chemical Industry Medal of the Society of Chemical Industry will be presented to Dr. J. V. N. Dorr, president of The Dorr Company, Inc., at a joint meeting of the American Section of the Society of Chemical Industry and the American Chemical Society on November 4, 1938, with Dr. Wallace P. Cohoe presiding. The medal is awarded annually for valuable application of chemical research to industry and will be given this year to Dr. Dorr in recogntion of his inventions and subsequent world-wide introduction of apparatus and processes in many chemical, metallurgical and sanitational operations which have made possible low cost production on a large scale. Dr. Dorr will present a paper entitled "The Influence of the Laws Relating to Research and Invention on Human Progress" and Mr. Howard C. Parmalee of the McGraw-Hill Publishing Co. will speak on the life and accomplishments of the medallist. The meeting will be held at 8:00 P.M. at The Chemists' Club, 52 East 41st Street, New York City. A dinner in honor of Dr. Dorr will also be held there preceding the meeting, starting at 6:45 P.M.

• duPONT EXHIBIT

E. I. du Pont de Nemours & Company recently announced plans for an extensive exhibit at the San Francisco Golden Gate Exposition.

The company has leased approximately 6,500 square feet in the Homes and Gardens Building, and will erect a completely self-contained structure of its own within the walls of the building. It will house a series of dramatized presentations showing the social contributions of chemistry. Purpose of the display, officials indicated, is an interpretation of the achievements of America's diversified chemical industry to the West Coast area.

Plans now being completed call for a number of animated displays tracing the means by which chemists convert simple raw materials into a wide variety of useful products. The important place of scientific research in the pattern of the industry will be emphasized, showing the opening of new avenues of employment through new chemical developments. The practical application in influencing style, beauty, agriculture, economics, health and other phases of modern life will be delineated.

The general scheme of the display will be a demonstration of the company's five leading raw materials, coal, cotton and wood, salt, ores and vegetable oils and their transformation into finished products. Among those to be shown will be man-made textile fibers, plastics, and derivation of synthetic materials such as chemically-made rubber and camphor, manufacture of lacquers and automotive finishes, refrigeration fluids, transparent wrapping film, and other materials effecting both the consumer and the heavy-duty work of industry.

An example of the simplified story to be told at the exhibit, will be a huge lump of coal which contains a mechanism giving off perfume when a handkerchief is held against it, body electricity actuating the device. This is intended to show the origin of many perfumes of today from coal tar, one of the most interesting of the chemist's more recent laboratory triumphs.

In another display, a lecturer will actually manufacture chemically-made rubber, pouring together liquids from beakers, then moulding the plastic compound into form in their hands.

Participation in the Exposition will bring a complete picture of the company's activities to the Pacific Coast for the first time. The company stated in announcing plans that it welcomed the opportunity to stress the community of interest it finds with the Western States.

• LIQUIDATE DYEING PLANT

The Reconstruction Finance Commission has just approved the sale of the machinery and equipment of the Textile Dyeing & Printing Co. of America to Consolidated Products Co., Inc., liquidation specialists of 15 Park Row, New York City.

The Textile Dyeing & Printing Co. is said to be the largest single dyeing and finishing and printing plant in the United States, and represents an investment of close to $10,000,000. The plant is one of the most modern ever offered for liquidation. The entire print shop was built in 1930 and all of the printing machinery was installed between 1930 and 1934.

The Textile Dyeing & Printing Co. processed rayons, acetates, and pure dye silk and has lately been re-equipped for spun rayon. It has a total capacity of 4,000 to 5,000 pieces per day, and the dye house and boil-off plant was enlarged and expanded in 1930.

The Consolidated Products Co. are liquidating the equipment piecemeal.

• CHEMICAL FOUNDATION LOSES APPEAL

On September 23, 1938, the U. S. Circuit Court of Appeals handed down its decision unanimously affirming the decree of the U. S. District Court for the District of Delaware, which had dismissed the complaint of the Chemical Foundation, Inc., to compel the transfer to it of titles to certain patents granted to Richard Herz, and assigned by him to General Aniline Works, Inc. These patents cover the manufacture of intermediates for the production of the well known Hydron Pink and Orange.

General Dyestuff Corporation is sole sales agent for General Aniline Works, Inc.

• PERKIN MEDAL AWARD

Dr. Walter S. Landis has been elected to receive the Perkin Medal of the Society of Chemical Industry for 1939. The medal is awarded annually for valuable work in applied chemistry and will be presented this year to Dr. Landis for his work on cynamid, derivatives of cyanamid, fertilizers, ammonium phosphate in particular, the first commercial production of argon and contributions to the explosive industry. The selection is made by a committee representing the five chemical societies in the United States.

The medal will be presented on January 6, 1939, at a meeting to be held at The Chemists' Club, 52 East 41st Street, New York City. Details will be announced later.

• duPONT RELEASE

A new acid black, "*Pontacyl*"* *Blue Black RC,* is announced by the Dyestuffs Division of the du Pont Company. This new color is of special interest for the dyeing of woolen piece-goods containing viscose process rayon effect threads, since it is said to leave rayon fibers white. It is also designed for application on wool in all stages of manufacture. "Pontacyl" Blue Black RC is slightly redder in shade than "Pontacyl" Blue Black SX but equal to it in strength and similar in fastness properties. It is claimed that it presents no application problems since it levels, penetrates and exhausts well, and solutions of it do not gelatinize on cooling.

* "Pontacyl" is a registered trade mark of the du Pont Company.

OPEN FORUM

Rules under which this department of the REPORTER is conducted are as follows:

1. Anyone who has a technical problem on which he would like advice may submit it to the Reporter and it will be published in the first available issue.

2. Any reader who feels that he has a solution of the problem may forward his reply to us and if we feel that the reply is suitable it will be published in a succeeding issue.

3. For each such reply published the Reporter will pay a minimum of $2.

4. In case there is more than one answer to the same question, the one covering the subject in the most complete and authentic manner will be published, or if two answers are sufficiently different both will be published. If two answers are considered equally good, the one first received will be given priority.

5. The Reporter will assume no responsibility whatsoever for the accuracy of the answers submitted—it is simply offering a vehicle for the public expression of its readers' opinions.

6. Both the questioner and answerer must send in his complete name and address. When requested we will publish only the initials or other identifying insignia.

Unanswered Question

46—A discussion has arisen in our plant as to the actual physical causes of scroop on silk fibers. Is this effect visible under the microscope, and if not, what is the actual physical change between unscrooped and scrooped silk? Several theories have been evolved with regard to this, none of which seem to hold water, and I would appreciate it very much if some one could assist me in shedding some light on this subject.—**A.G.A.**

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CLASSIFIED

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

POSITION WANTED: Three years' experience in dyestuff laboratory; also demonstrated. Experienced with all types of dyestuffs and materials. Philadelphia Textile School graduate. Age 23. Single. Write Box No. 152, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: Assistant Superintendent desires position. Experienced in bleaching, dyeing and finishing pile fabrics and cotton piece goods. Age 28. B.S. in Chemical Engineering, University of Penna. Graduate of Phila. Textile School. Write Box No. 155, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: Assistant chemist and dyer, seven years practical laboratory and plant experience, experienced in dyeing and printing of cotton fabrics and unions. Single, age 28, Textile School graduate. New England territory preferred. Open to any position. References. Write Box No. 156, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: Lowell Textile graduate, 3 years dyeing laboratory, color matching and testing, 2 years analytical work and plant chemist (industrial plant). Contact work and sales research experience. Write Box No. 157, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.